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Spring 5-2016

## Where Wellness Begins

Chelsea M. Wheeler

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Tested - Low Impact Building Materials

Infrastructure

Thermal Controls

## Well Building Standards

Technology integration

Legislation - Public Policies

Vegetation

Daylighting

Relaxation -escape from urban

ces

## Mental Health

Stimulating Opportunities  
for urban participation

Noise Control

Neighborhood Groupings



# Thesis Design Application:

Daylight, Ventilation and Vegetation

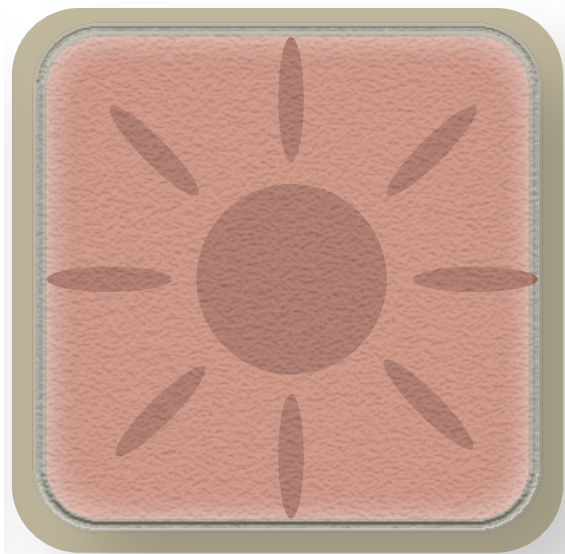
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Vegetation

Primary Element:

Analyzed Effectiveness  
Programmatic Considerations



Natural Light

Secondary Element:

Programmatic  
Considerations



Fresh Air



Vegetation

Tertiary Element:

conscious



Community



Nutrition



Physical  
Activity



Medical Need



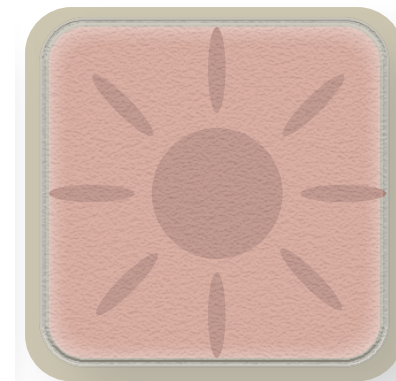
Occupant  
Satisfaction



Relaxation/  
Alertness

## Access To Natural Daylight: Analytic, Programatic and Concienscious Influences On Design

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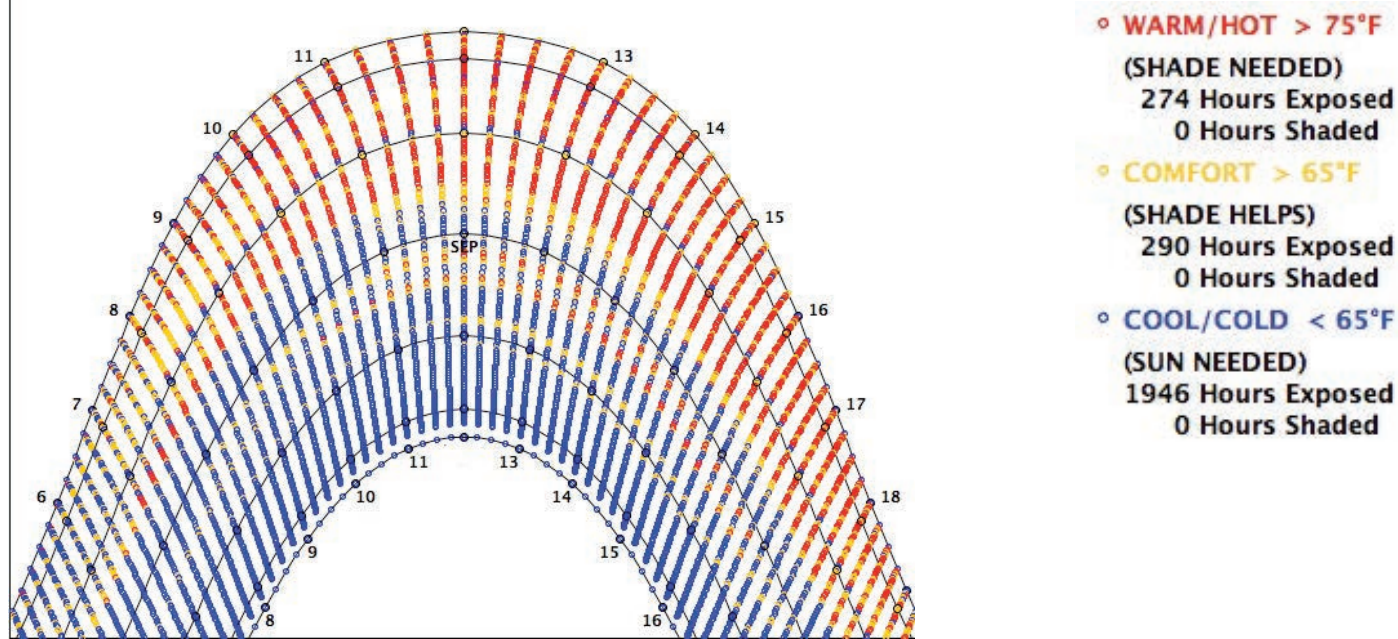
Natural Light

# Access To Natural Daylight: Climate Conditions



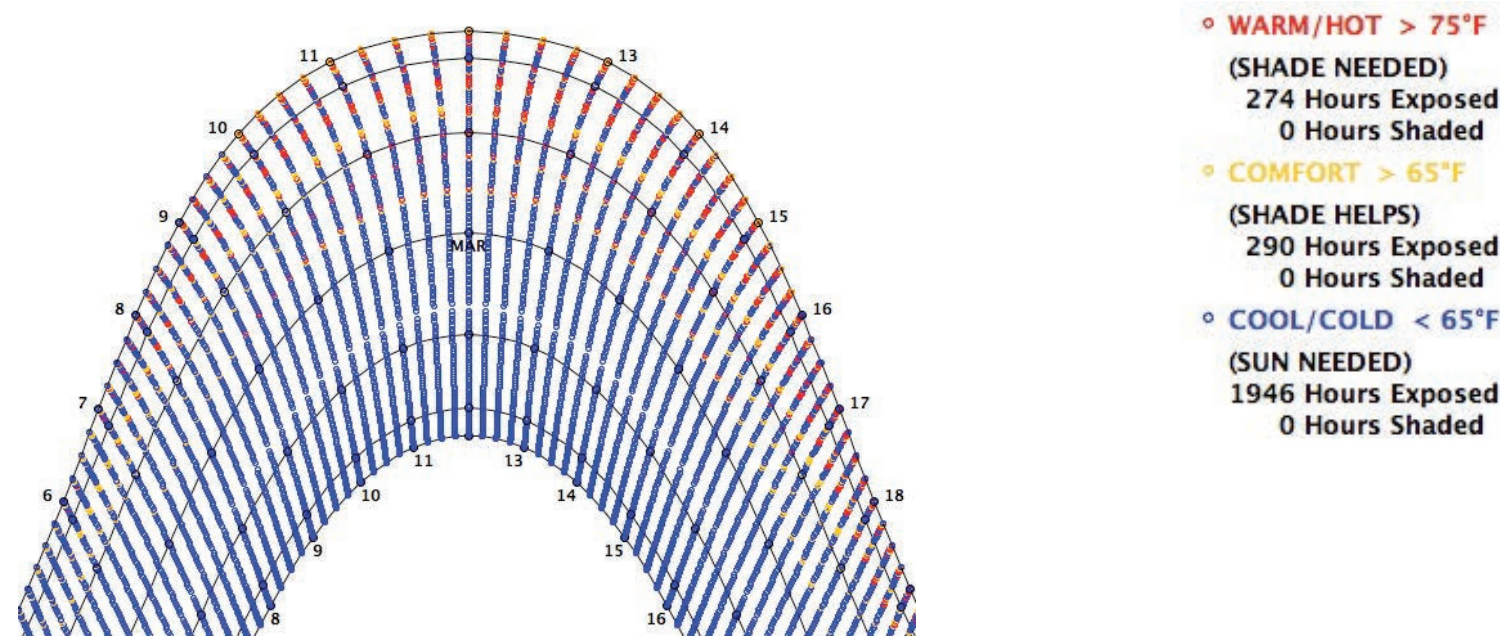
Natural Light

## June - December Sun Shading Chart



Summer months show evidence of high rates of heat gain that could be uncomfortable for occupants. Shading devices should be used to block light from parts of the building occupied during the summer. Since educational facilities are normally closed during the summer, this should not be a large concern. Spring Shading is necessary.

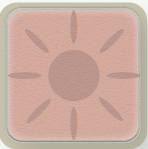
## December - June Sun Shading Chart



Winter Months show less radiation for the region providing fewer solar gains. Large southern windows with thermal materials could be used to take advantage of the solar energy available to help heat the spaces. Particularly, this will be necessary from December through February.

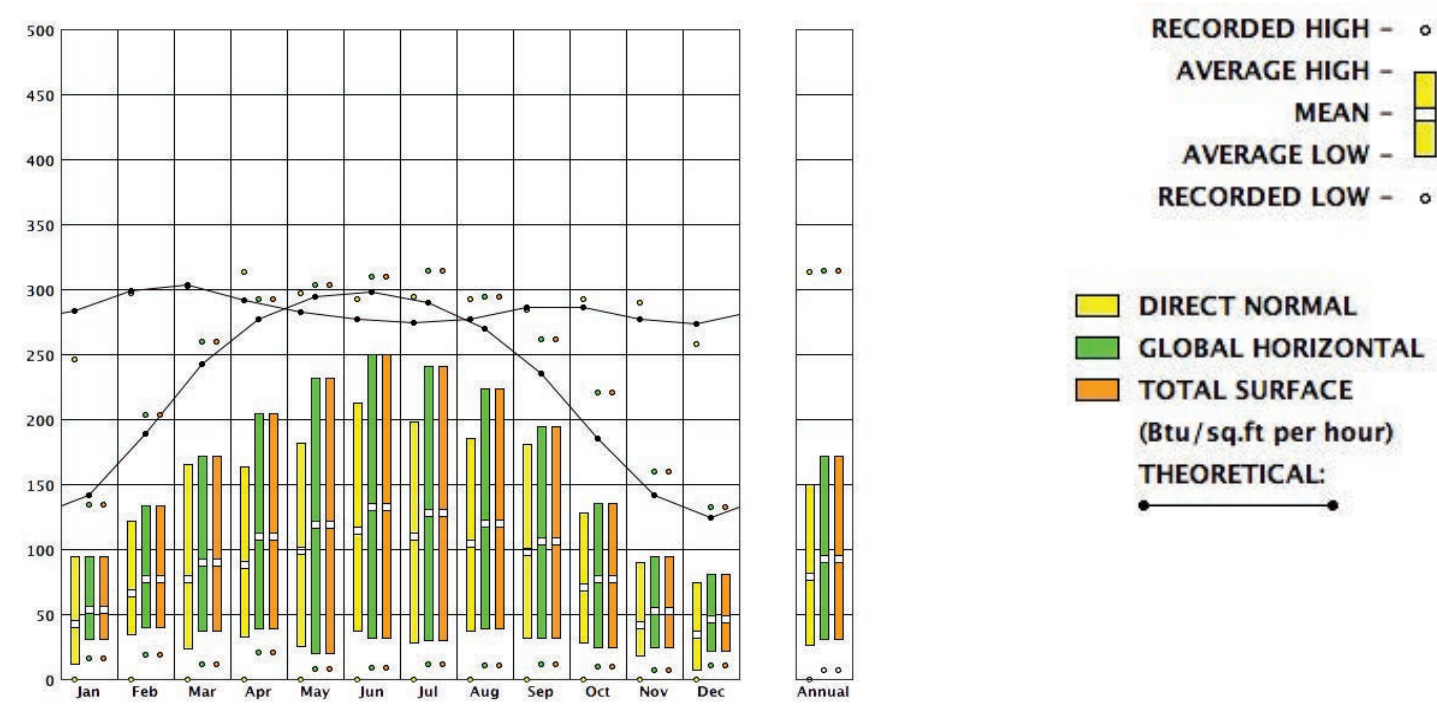


# Access To Natural Daylight: Climate Conditions



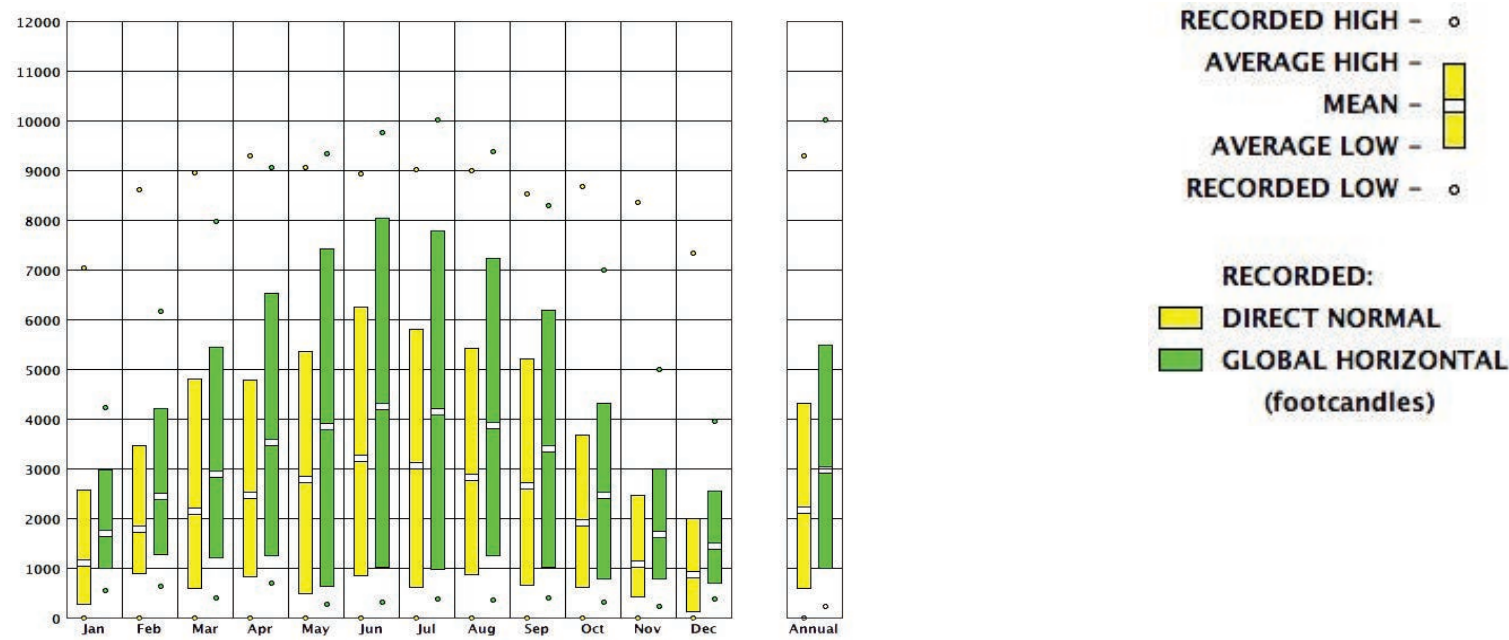
Natural Light

## Radiation Levels



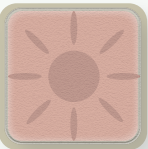
Radiation lvels are greatest during the months of April through September. These months offer the best opportunity for diffused lighting and sola gains. Direct and side lighting will provide more opportunities for radiation gainin the winter months.

## Illumination Range



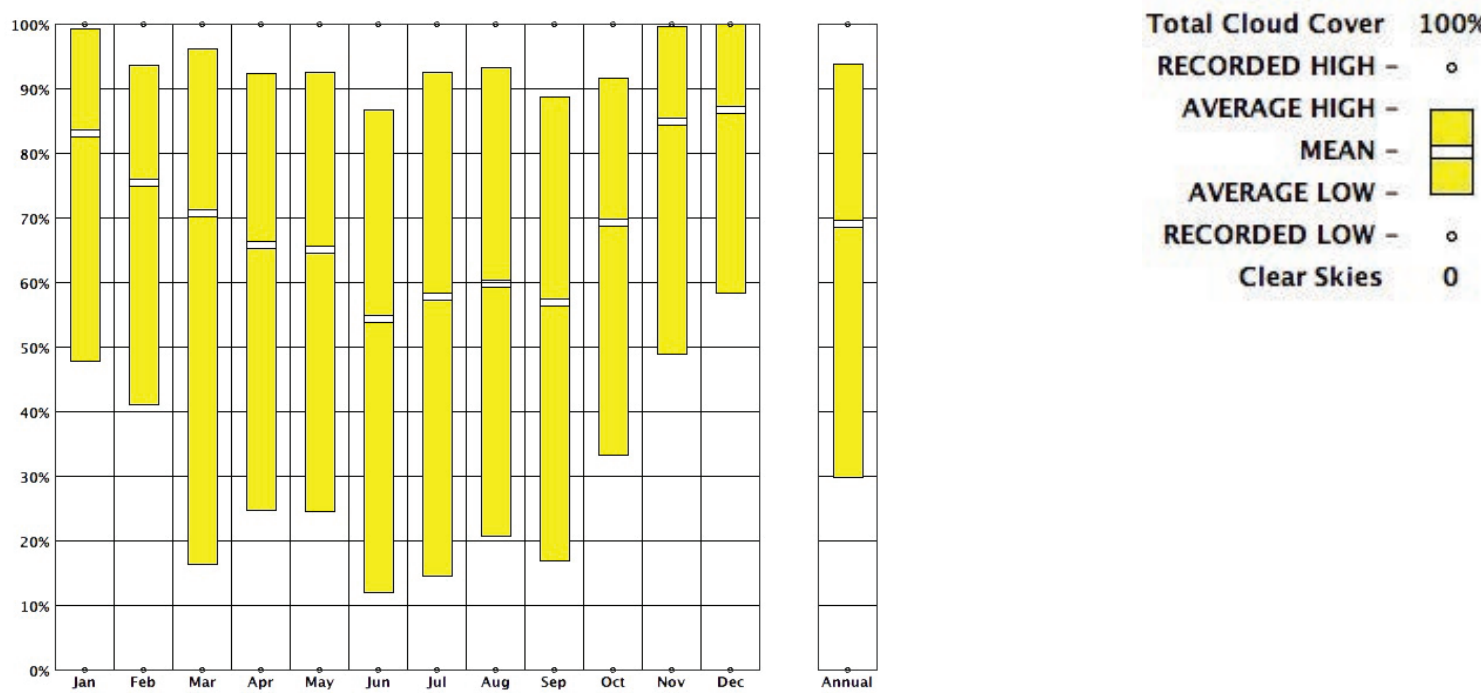
Illumination levels throughout the year suggest suficient light levels for day-lighting to accomodate most tasks most days of the year if utilized properly. Clerestory and skylights can be used to take advantage of these levels.

# Access To Natural Daylight: Climate Conditions



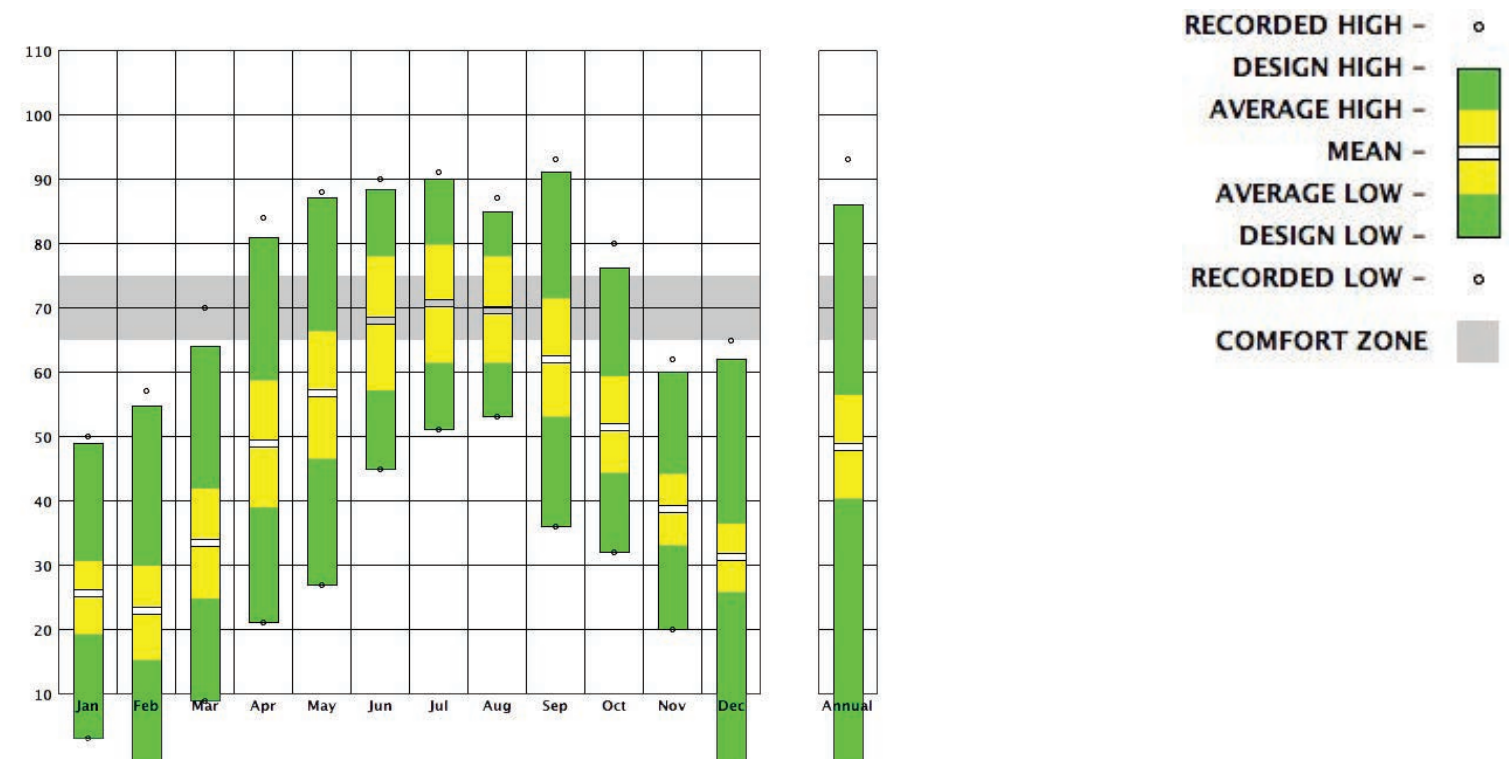
Natural Light

## Cloud Coverage



Cloud coverage throughout the year is relatively consistent suggesting little direct lighting. This may decrease the solar gains as seen in the above chart. Little direct lighting is expected from November through January. This may reduce the need for external shading devices particularly in the winter.

## Temperature Range



The natural temperatures during the school year are below comfort level. Heating will be required. This supports the use of large southern exposures for heat gain. Cooling can be handled through the use of proper ventilation and manually operated shading devices or electrochromic glazing.

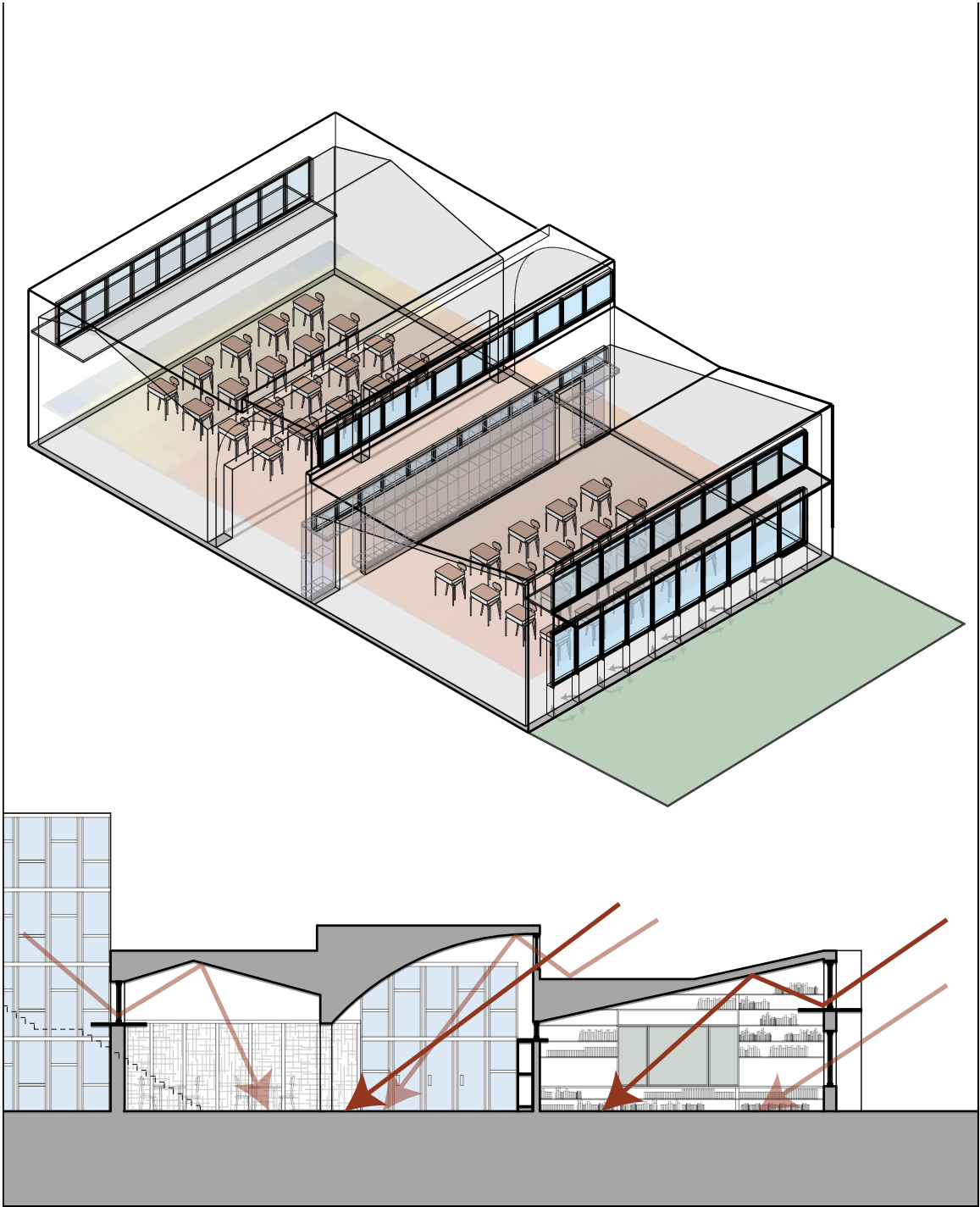
# Access To Natural Daylight: Classroom Unit Testing

In order to develop improved daylighting systems for the individual classrooms and building as a whole, it was necessary to develop a system of testing the building performance. As such, the classroom design developments produced for the new Blodgett Middle School were tested for daylight availability utilizing the daylight simulation software Rhino. Each iteration of the design was tested for daylight area a spatial indication of availability and daylight autonomy that measures the occupied times in which daylight is available. These numbers were compared to the existing conditions of Blodgett Middle School and an exemplary WELL building, the CBRE Headquarters in LA.

Tests were used to determine the best depth, height, window area, orientation, and ceiling angle to comply with the classroom requirements. The following pages caption this process that yielded the forms to the right of this page.



Natural Light

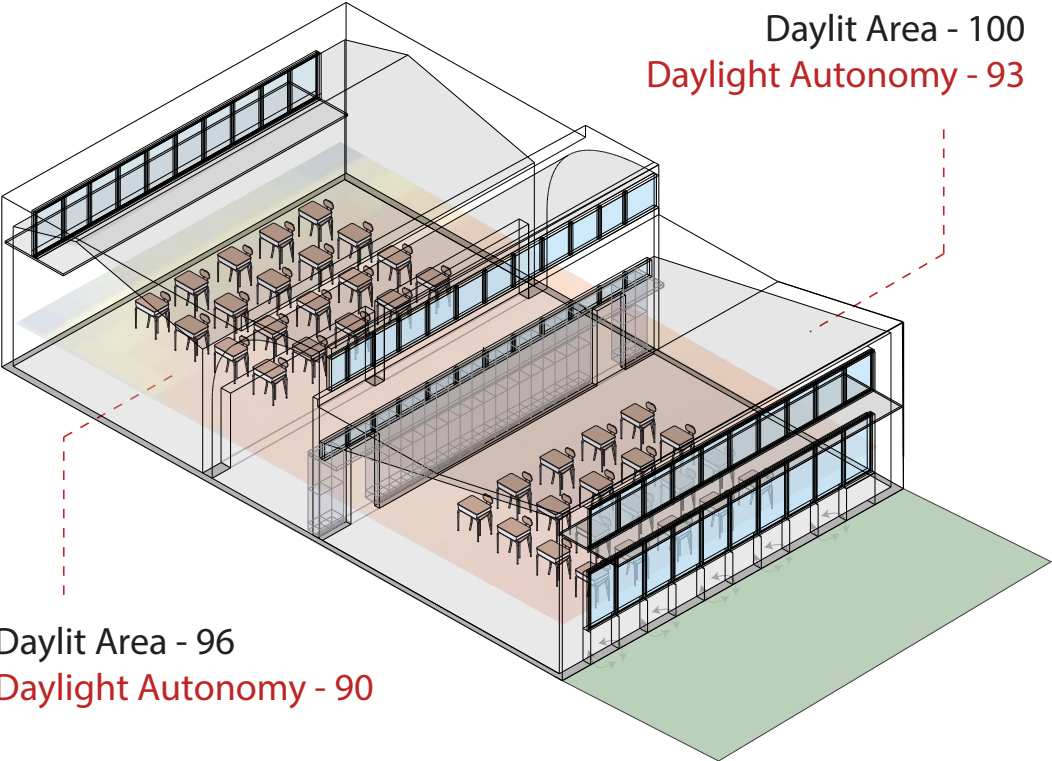




Blodgett School Classroom Lighting Design Studies:

Daylight Area + Daylight Autonomy  
Nearwest Side Syracuse NY

Optimized Classroom Design - Nearwest Side Syracuse NY

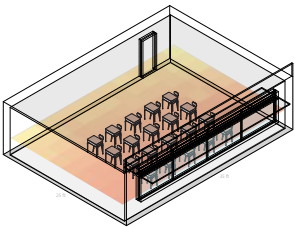
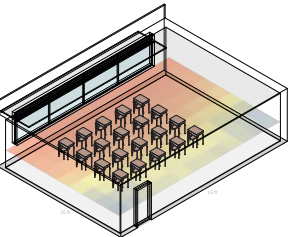
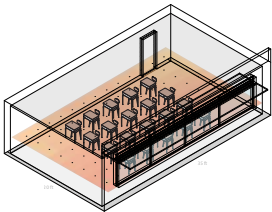
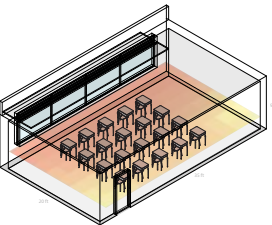


Daylit Area - 96  
Daylight Autonomy - 90

Light Shelf - Flat Ceiling

North Facing

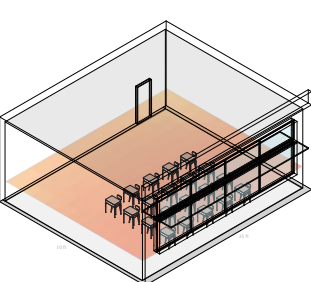
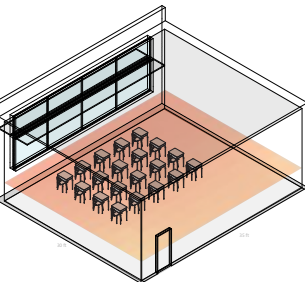
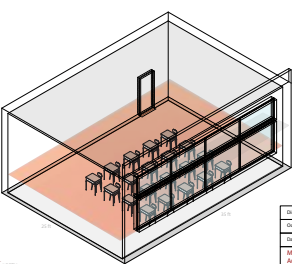
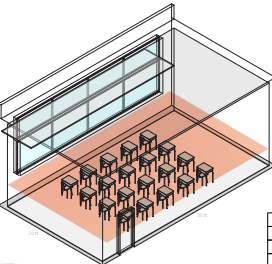
South Facing



Light Shelf - Flat Ceiling

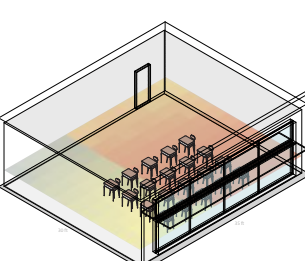
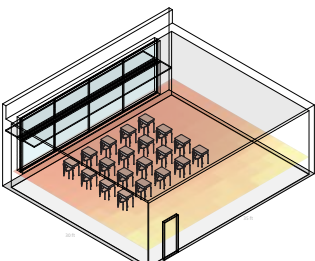
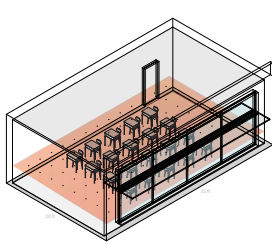
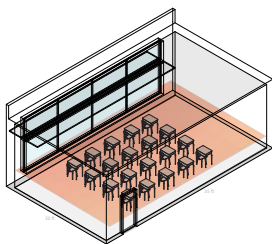
North Facing

South Facing



North Facing

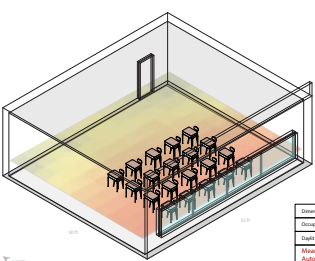
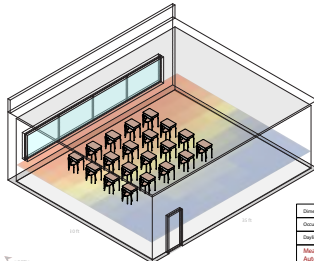
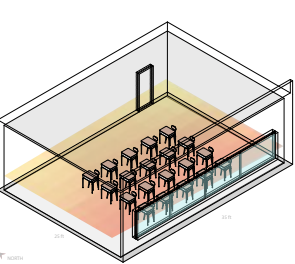
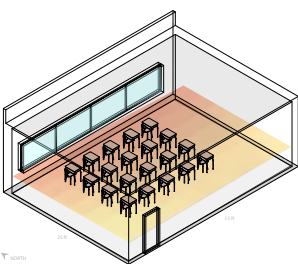
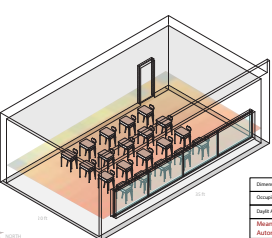
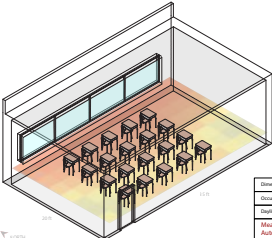
South Facing



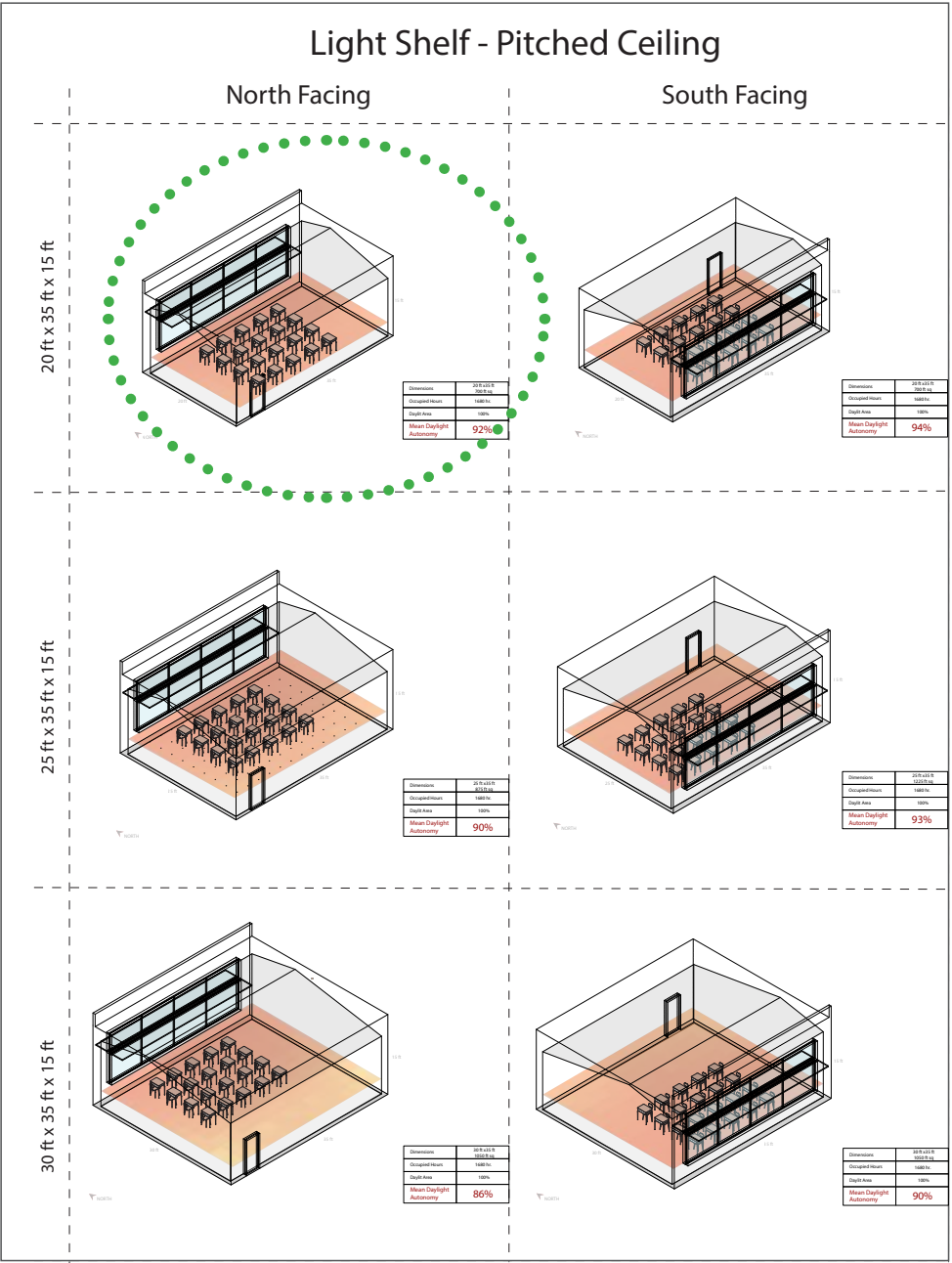
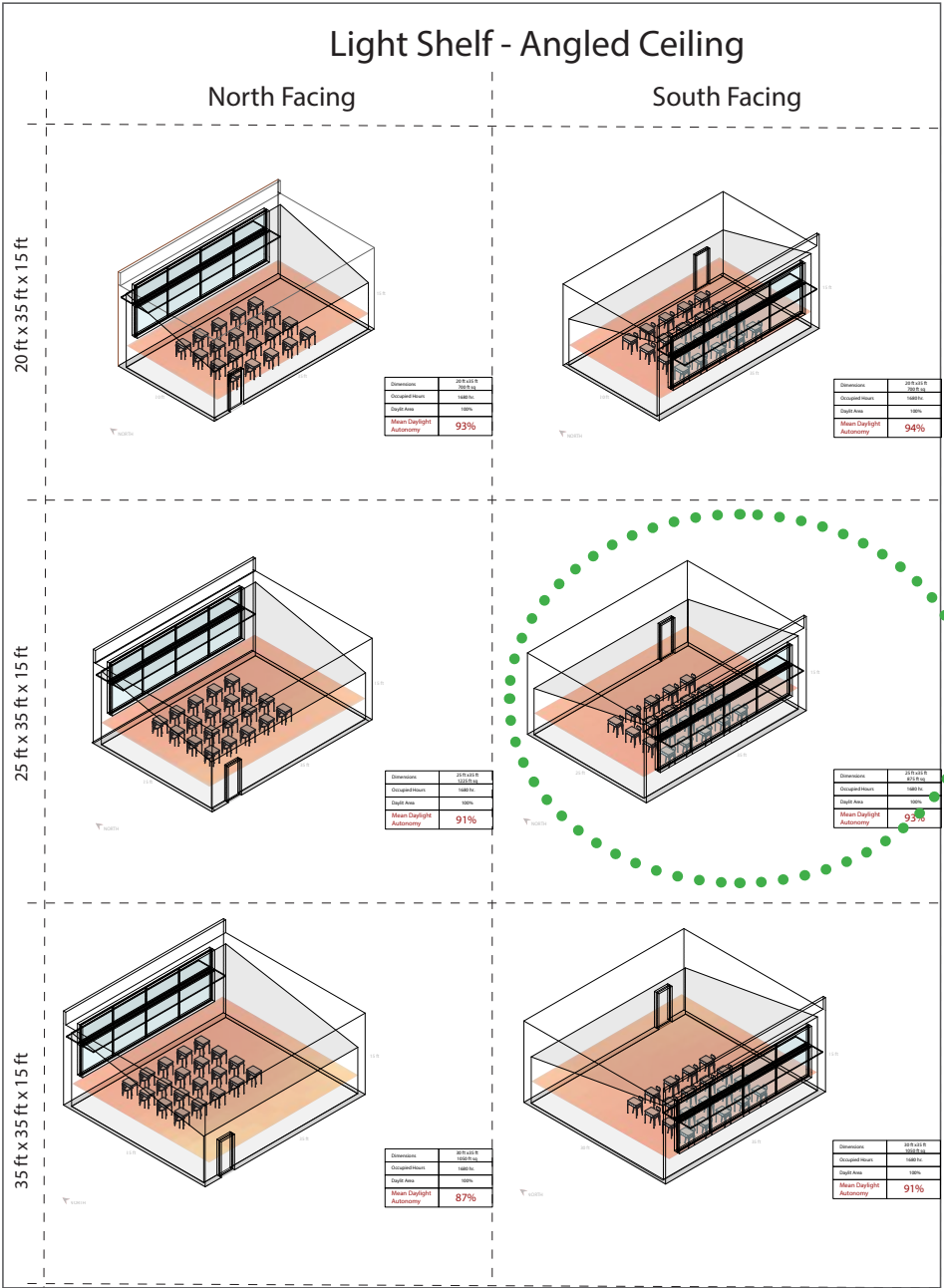
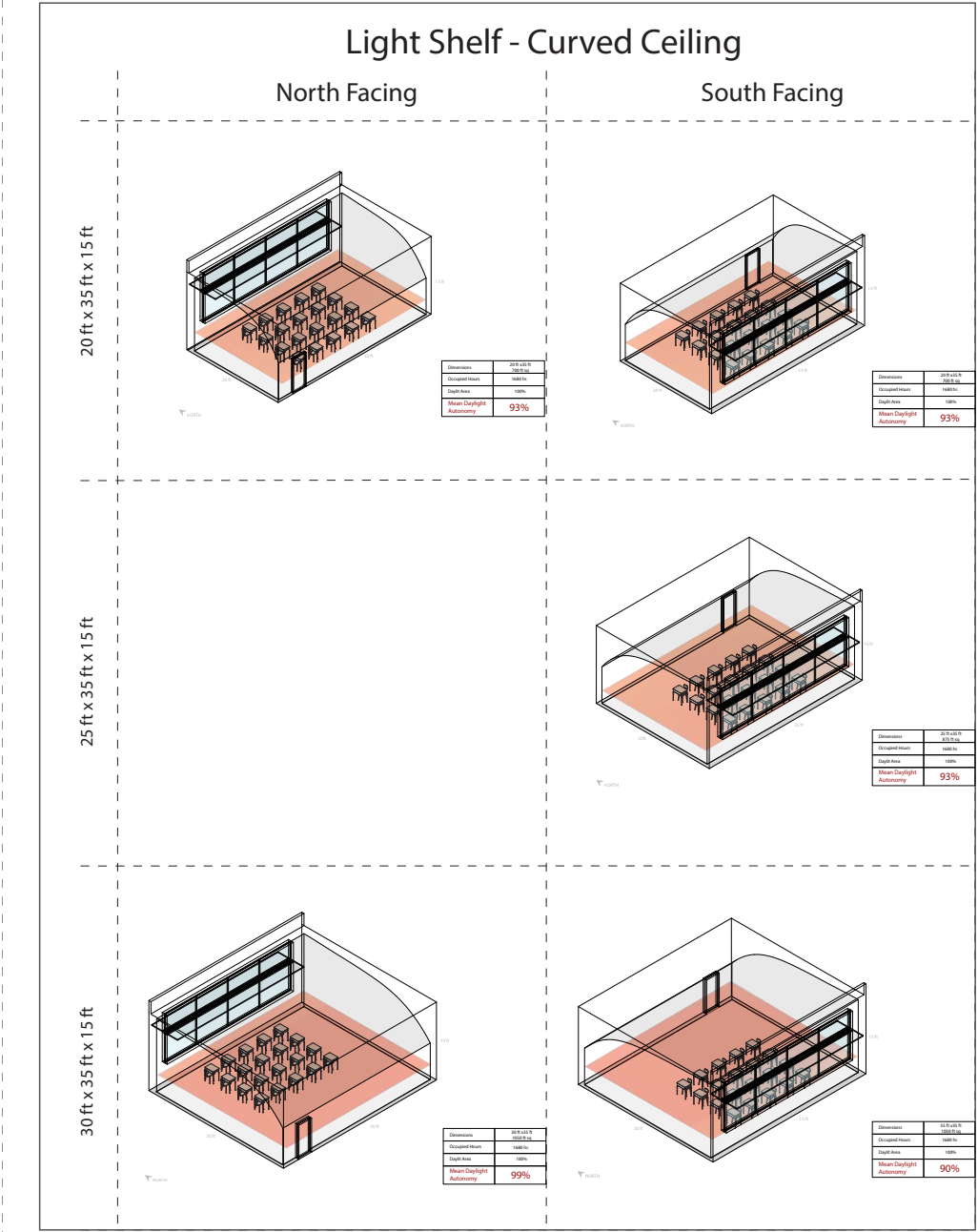
Simple Side Glazing

North Facing

South Facing





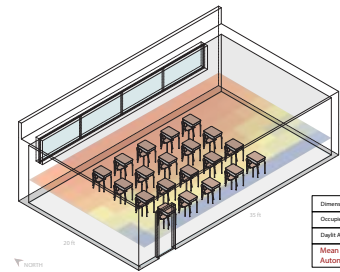


## Clerestory Windows - Simple Ceiling

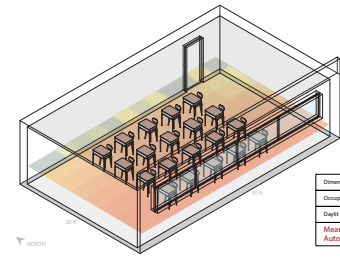
### North Facing

### South Facing

20 ft x 35 ft x 9 ft

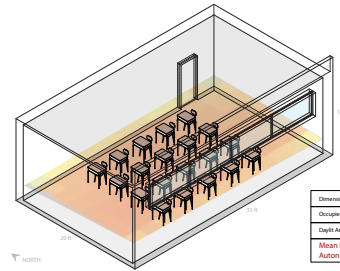


Dimensions	20 ft x 35 ft x 9 ft
Occupied Hours	1680 hr
Daylit Area	72%
Mean Daylight Autonomy	64%

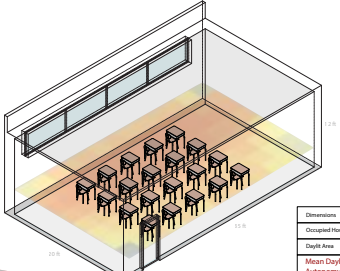


Dimensions	20 ft x 35 ft x 9 ft
Occupied Hours	1680 hr
Daylit Area	72%
Mean Daylight Autonomy	64%

25 ft x 35 ft x 12 ft

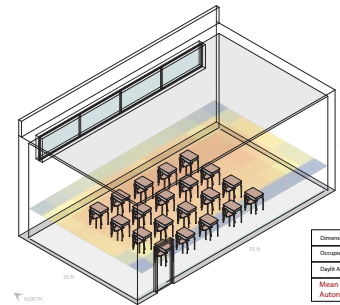


Dimensions	25 ft x 35 ft x 12 ft
Occupied Hours	1680 hr
Daylit Area	90%
Mean Daylight Autonomy	77%

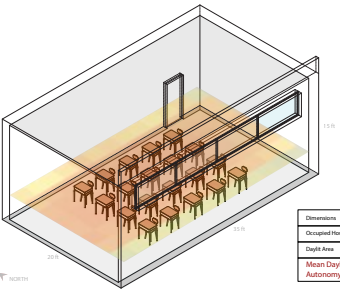


Dimensions	25 ft x 35 ft x 12 ft
Occupied Hours	1680 hr
Daylit Area	90%
Mean Daylight Autonomy	71%

30 ft x 35 ft x 15 ft

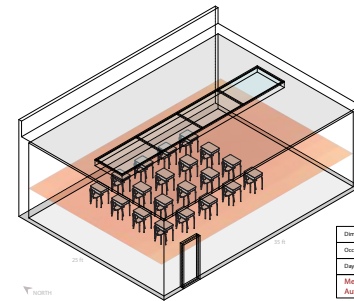


Dimensions	30 ft x 35 ft x 15 ft
Occupied Hours	1680 hr
Daylit Area	89%
Mean Daylight Autonomy	51%



Dimensions	30 ft x 35 ft x 15 ft
Occupied Hours	1680 hr
Daylit Area	87%
Mean Daylight Autonomy	71%

25 ft x 35 ft x 15 ft



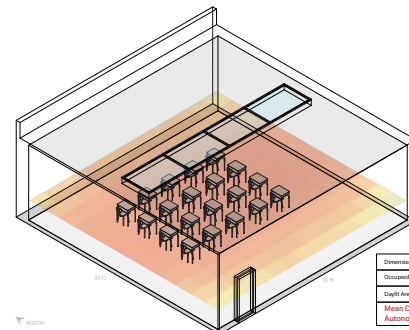
Dimensions	25 ft x 35 ft x 15 ft
Occupied Hours	1680 hr
Daylit Area	100%
Mean Daylight Autonomy	91%

## Skylights

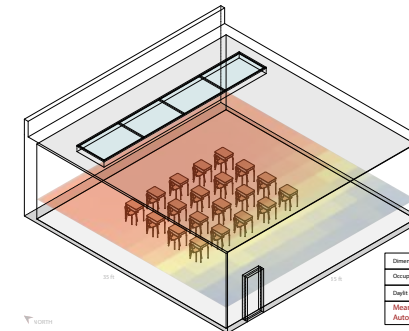
### Northern

### Southern

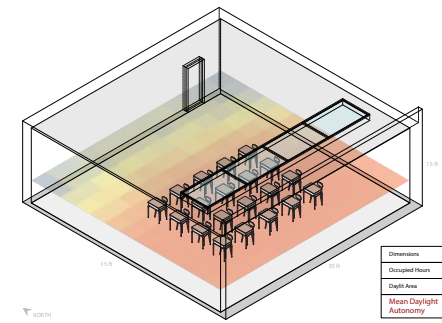
35 ft x 35 ft x 15 ft



Dimensions	35 ft x 35 ft x 15 ft
Occupied Hours	1680 hr
Daylit Area	88%
Mean Daylight Autonomy	84%

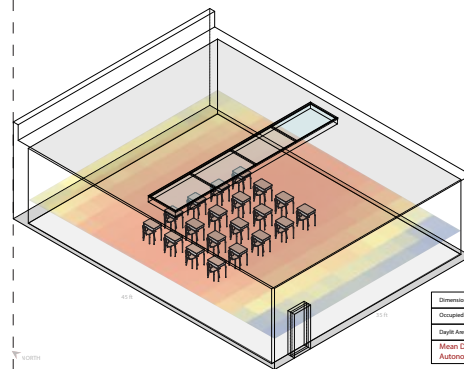


Dimensions	35 ft x 35 ft x 15 ft
Occupied Hours	1680 hr
Daylit Area	69%
Mean Daylight Autonomy	67%

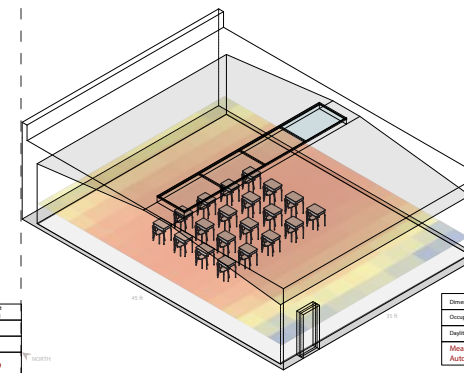


Dimensions	35 ft x 35 ft x 15 ft
Occupied Hours	1680 hr
Daylit Area	75%
Mean Daylight Autonomy	72%

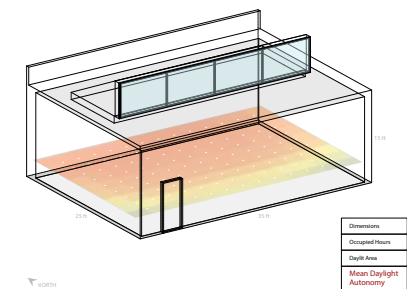
45 ft x 35 ft x 15 ft



Dimensions	45 ft x 35 ft x 15 ft
Occupied Hours	1680 hr
Daylit Area	80%
Mean Daylight Autonomy	72%



Dimensions	45 ft x 35 ft x 15 ft
Occupied Hours	1680 hr
Daylit Area	83%
Mean Daylight Autonomy	75%



Dimensions	45 ft x 35 ft x 15 ft
Occupied Hours	1680 hr
Daylit Area	85%
Mean Daylight Autonomy	74%

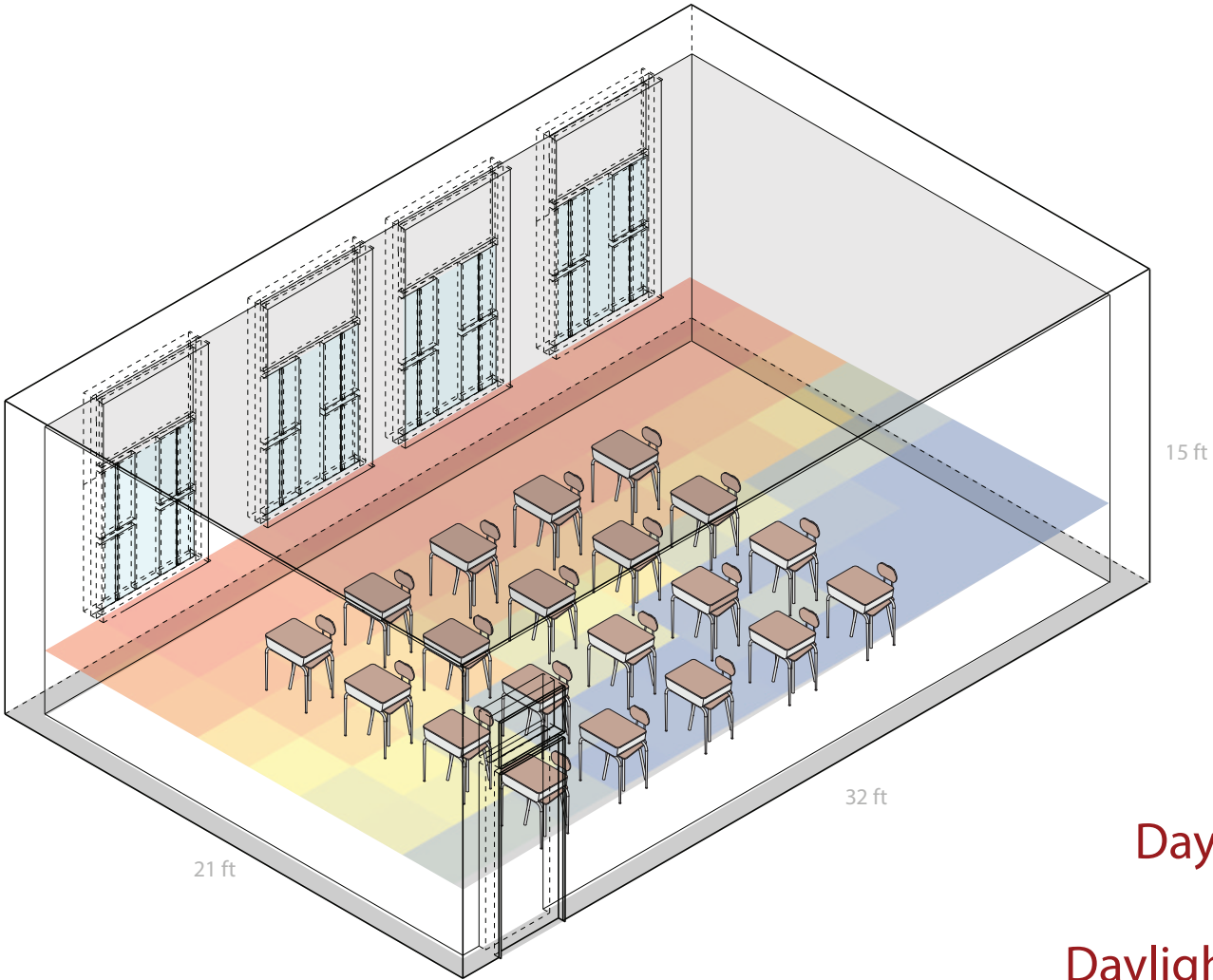


# Access To Natural Daylight:

## Classroom Unit Testing - Comparing Results Existing to Proposed



Existing Conditions -Blodgett Classroom

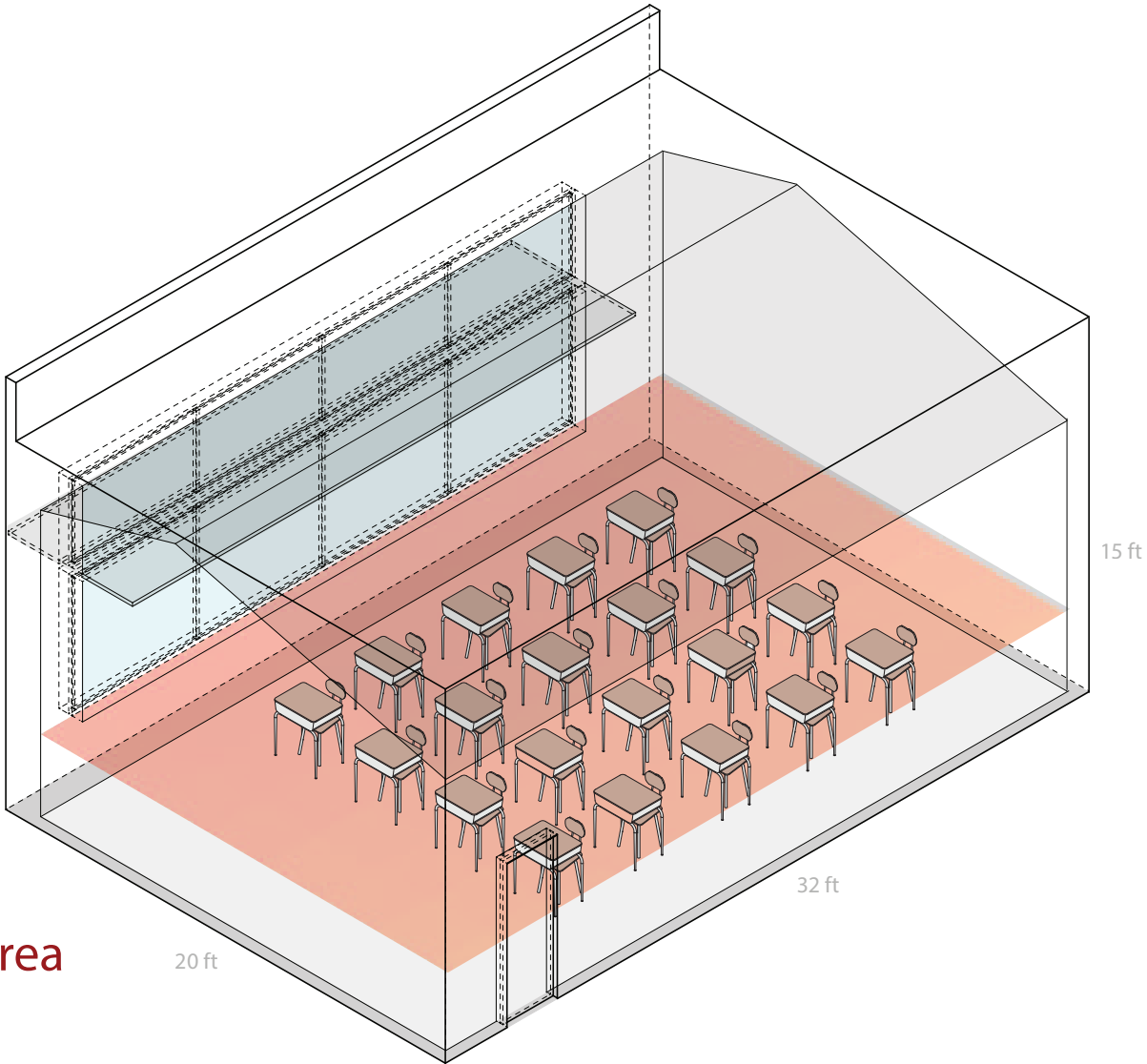


In order to compare these structures, the floor area was adjusted to match. Similar orientations were also selected to provide the most comperable results.

Through testing, the daylighting availability was improved. This can then be adjusted with manual shading devices to acomodate different needs.

Dimensions	21 ft x 32 ft 672 ft sq
Occupied Hours	1680 hr.
Daylit Area	55%
Mean Daylight Autonomy	50%

Designed Conditions - Proposed Blodgett Classroom

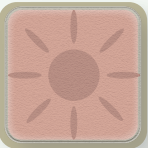


+ 45%  
Daylight Area  
+ 42%  
Daylight Autonomy

Dimensions	20 ft x 33.3 ft 672 ft sq
Occupied Hours	1680 hr.
Daylit Area	100%
Mean Daylight Autonomy	92%

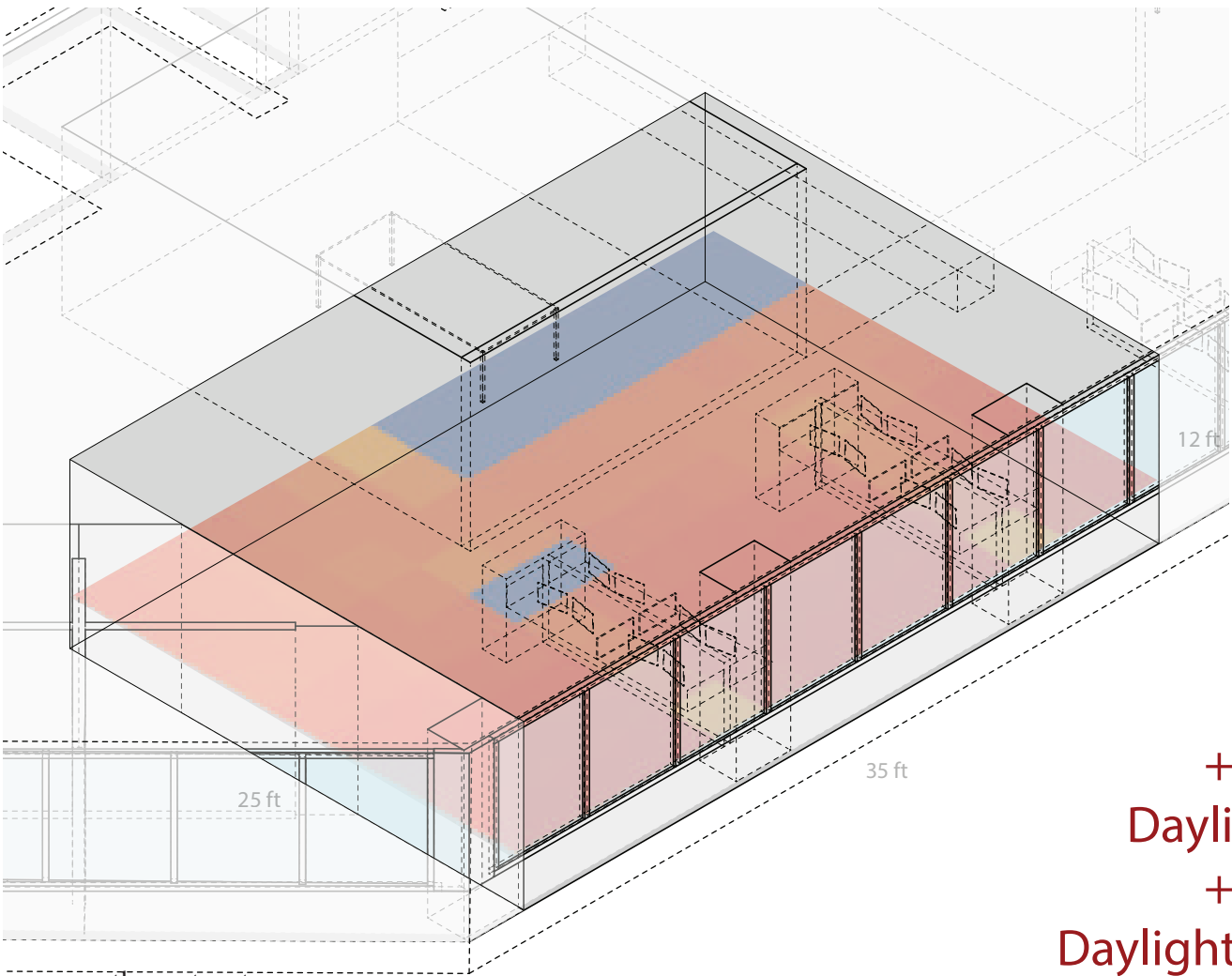
# Access To Natural Daylight:

Classroom Unit Testing - Comparing Results Existing to Proposed



Natural Light

## Existing Conditions -CBRE Headquarters LA

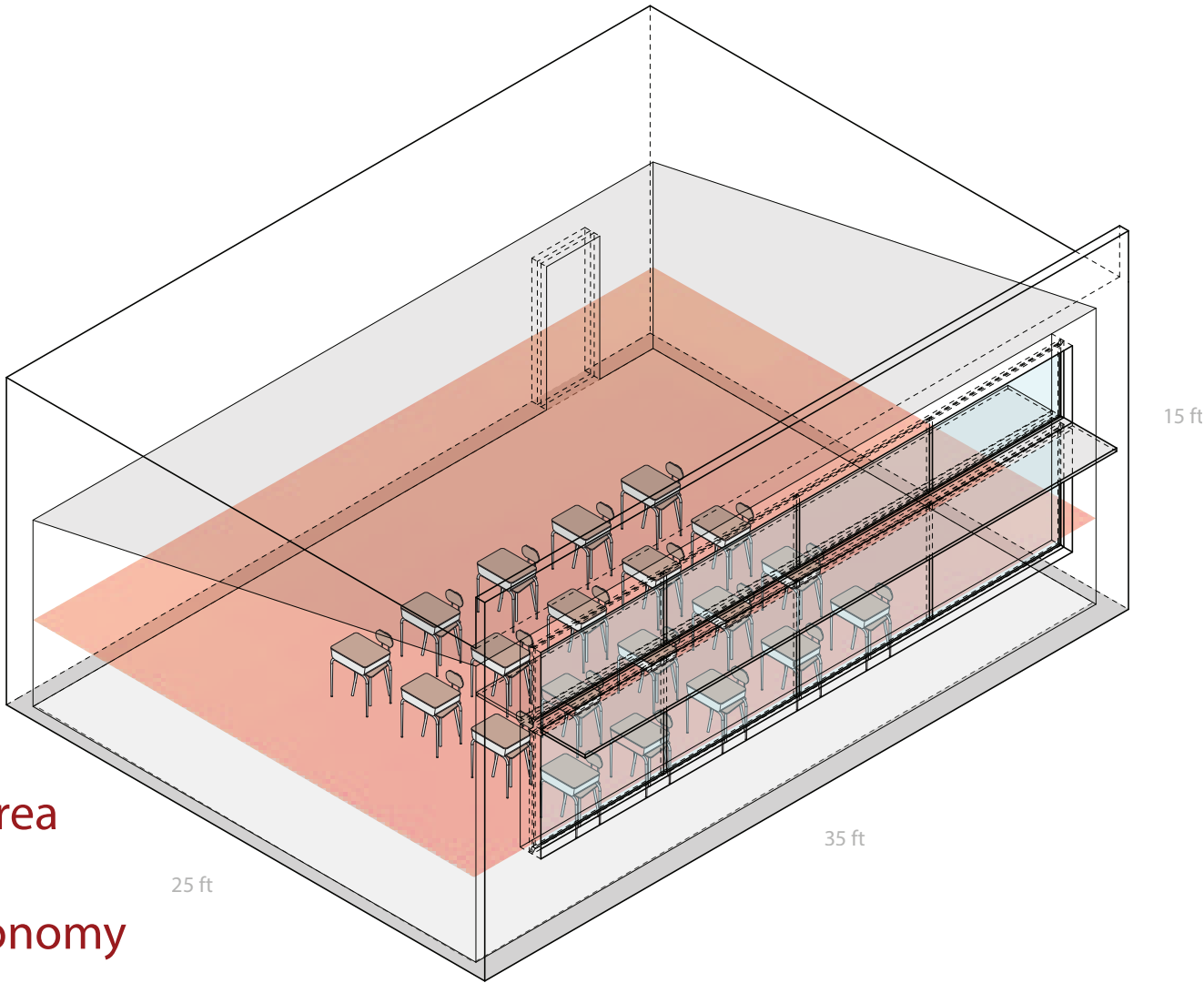


In order to compare these structures, the floor area was adjusted to match. Similar orientations were also selected to provide the most comperable results.

Through testing, the daylighting availability was improved. This can then be adjusted with manual shading devices to acomodate different needs.

Dimensions	35 ft x25 ft 875 ft sq
Occupied Hours	1680 hr.
Daylit Area	86%
Mean Daylight Autonomy	81%

## Proposed Conditions - Blodgett Classroom



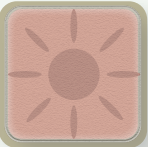
NORTH

Dimensions	25 ft x35 ft 875 ft sq
Occupied Hours	1680 hr.
Daylit Area	100%
Mean Daylight Autonomy	93%

+ 17%  
Daylight Area  
+ 12%  
Daylight Autonomy



# Access To Natural Daylight: Classroom Unit Testing - Resulting Spaces



Natural Light





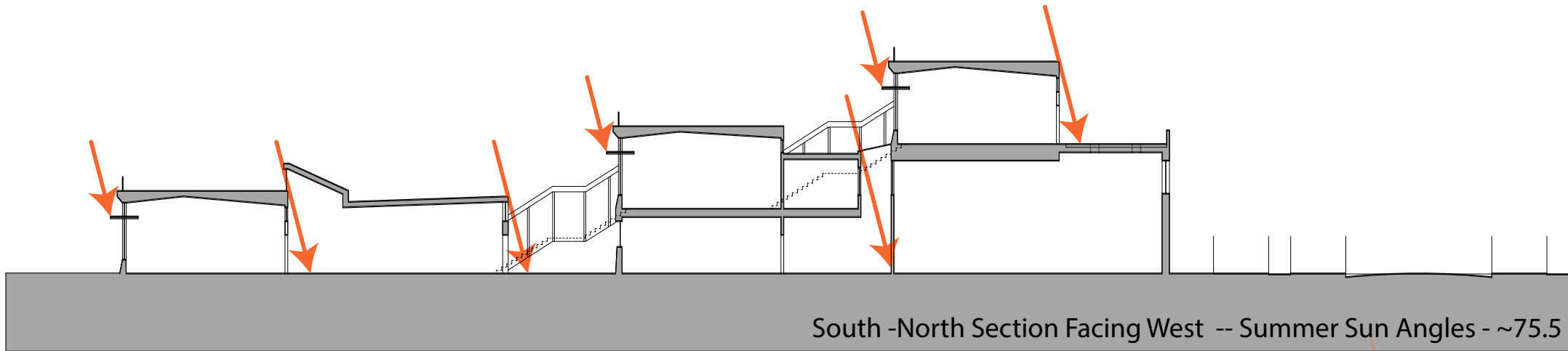
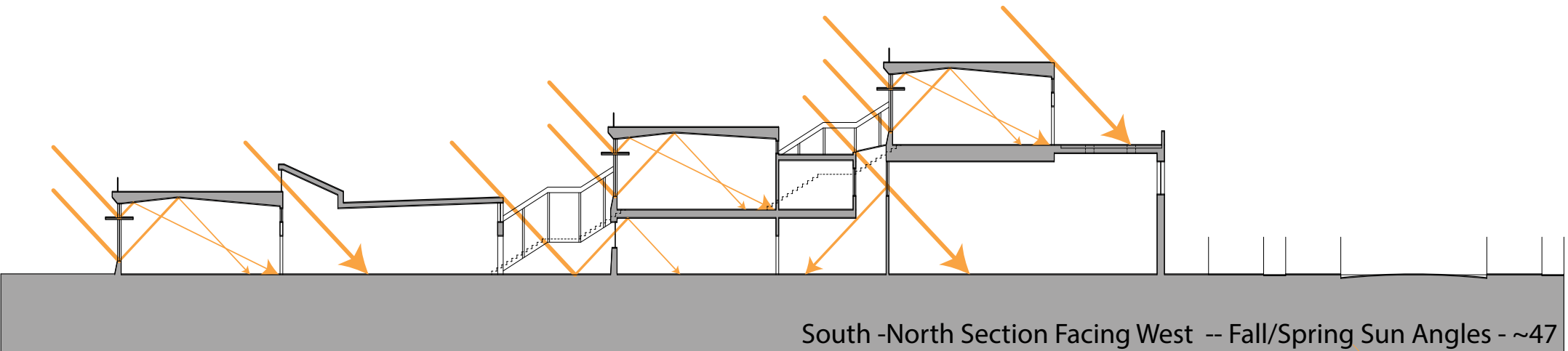
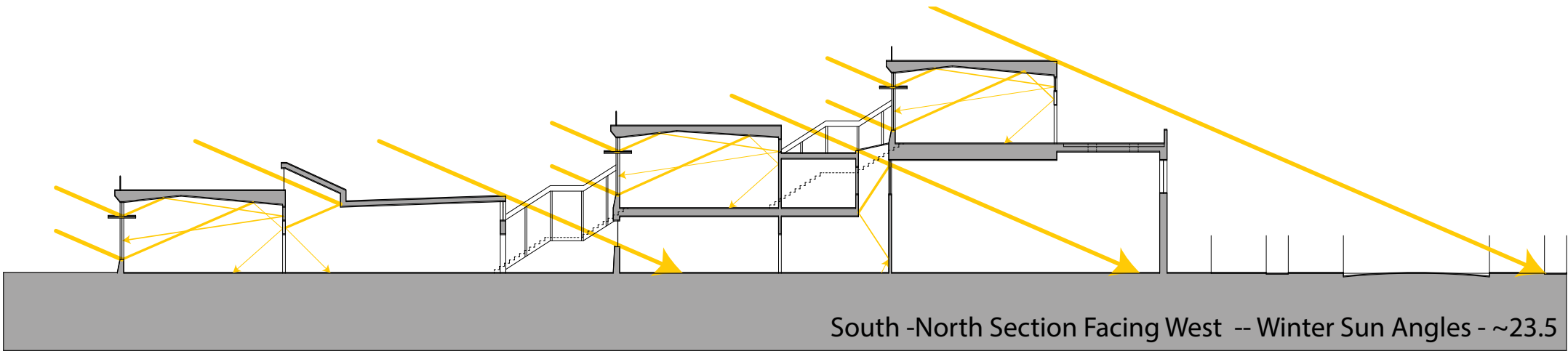
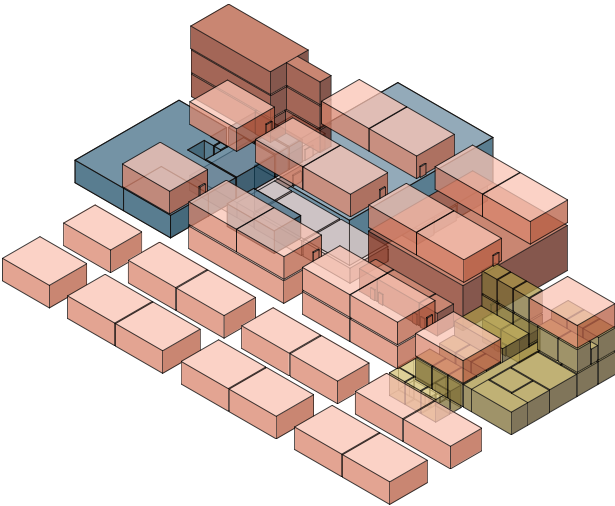
# Access To Natural Daylight: Classroom Organization Strategies



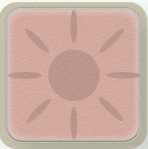
Natural Light

The design and selected classrooms for the new Blodgett Middle School require primarily southern exposure and access to daylighting all year. This required a tiered system of organization. The classrooms were arranged according to the mid season solar angles of Syracuse NY allowing for adequate spacing to ensure access to southern exposure by every classroom.

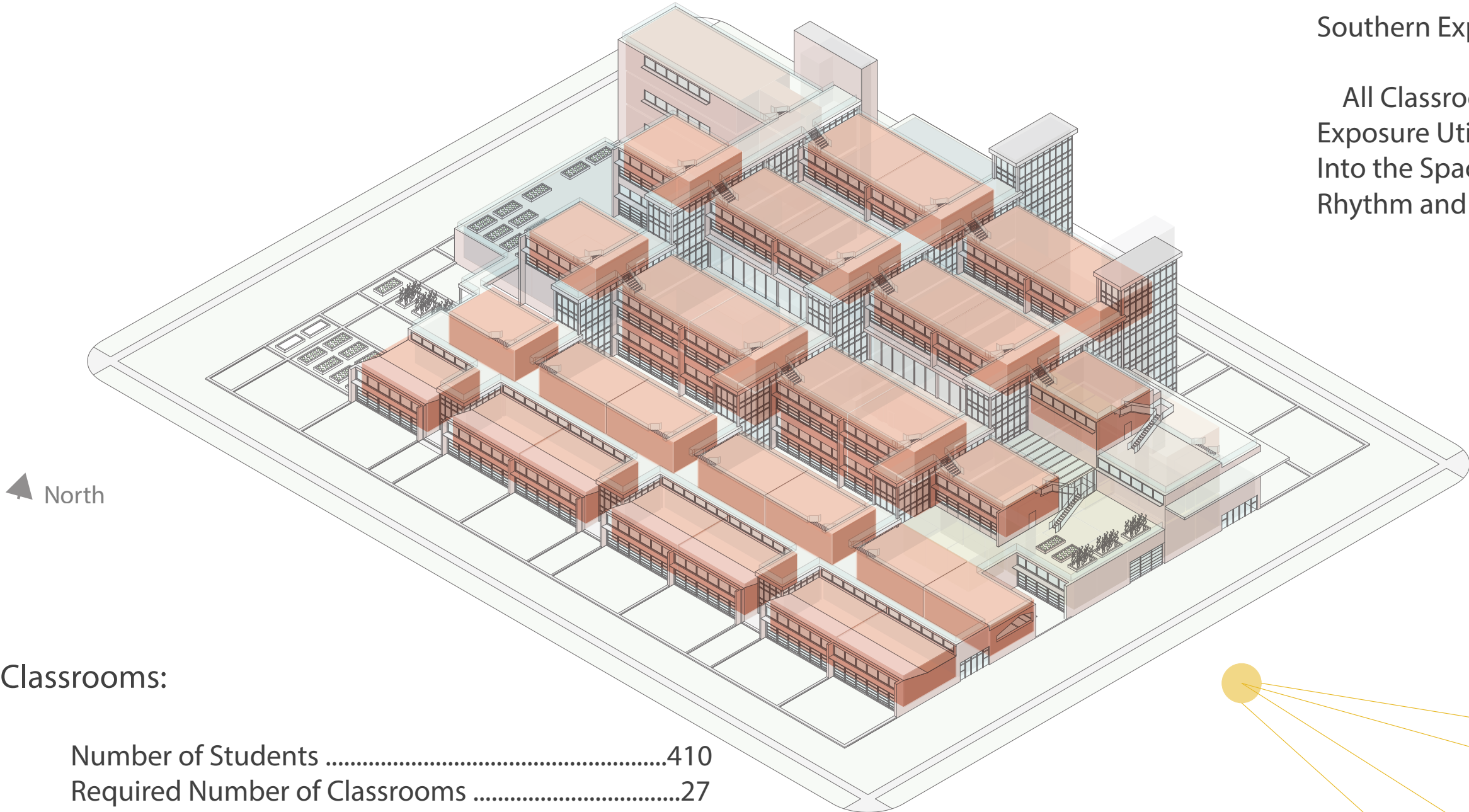
From this organizational strategy, the program was delineated. The next several slides describe this process of program organization



# Access To Natural Daylight: Classroom Organization Strategies - Classrooms



Natural Light

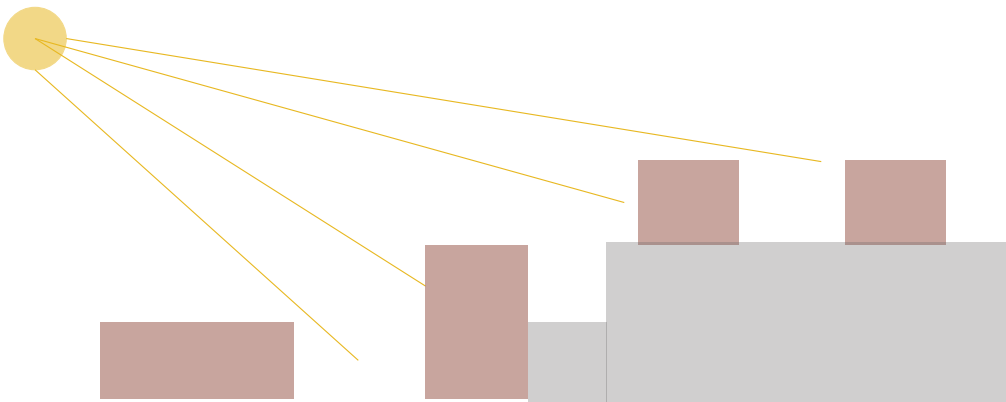


## Southern Exposure:

All Classrooms Are Provided With Southern Exposure Utilizing Light Shelves to Diffuse Light Into the Spaces Providing Proper Circadian Rhythm and Improved Alertness

## Classrooms:

Number of Students .....	410
Required Number of Classrooms .....	27
Number of Classrooms Provided .....	36
Traditional Classrooms .....	28
Innovative Work Zones .....	8



# Access To Natural Daylight:

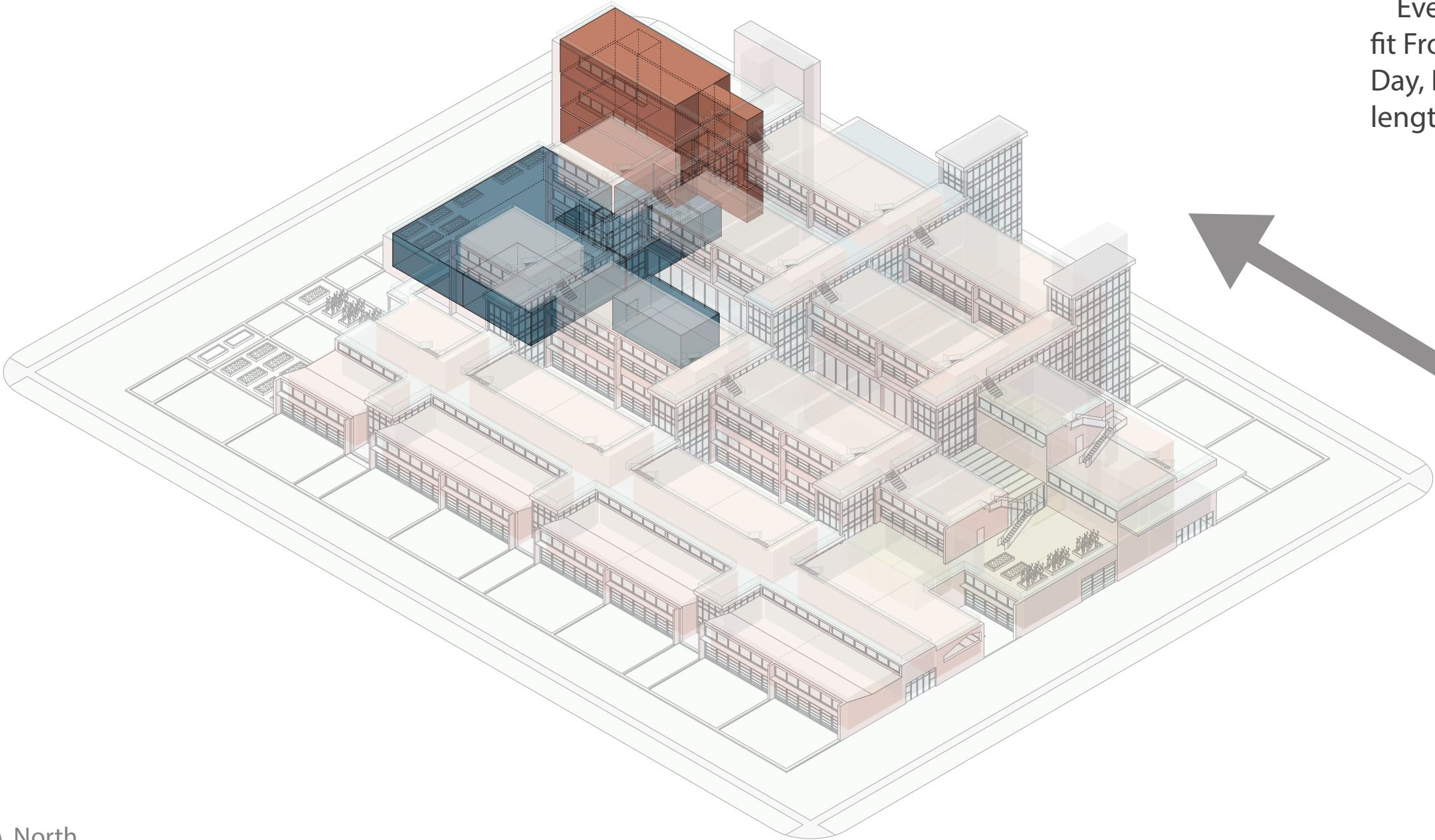
Classroom Organization Strategies - Cafeteria and Resource Center



Natural Light

Western Exposure:

Evening Activities and Relaxed Settings Benefit From Sunlight During The Latter Half Of The Day, Providing Warmer, Calming Infrared Wave-lengths From The lower Sun-Angles



Resource Center - Library and Technology Spaces  
-Host After School Activities



Cafeteria - Dining, Kitchen, and Gardens  
-Host After School Activities



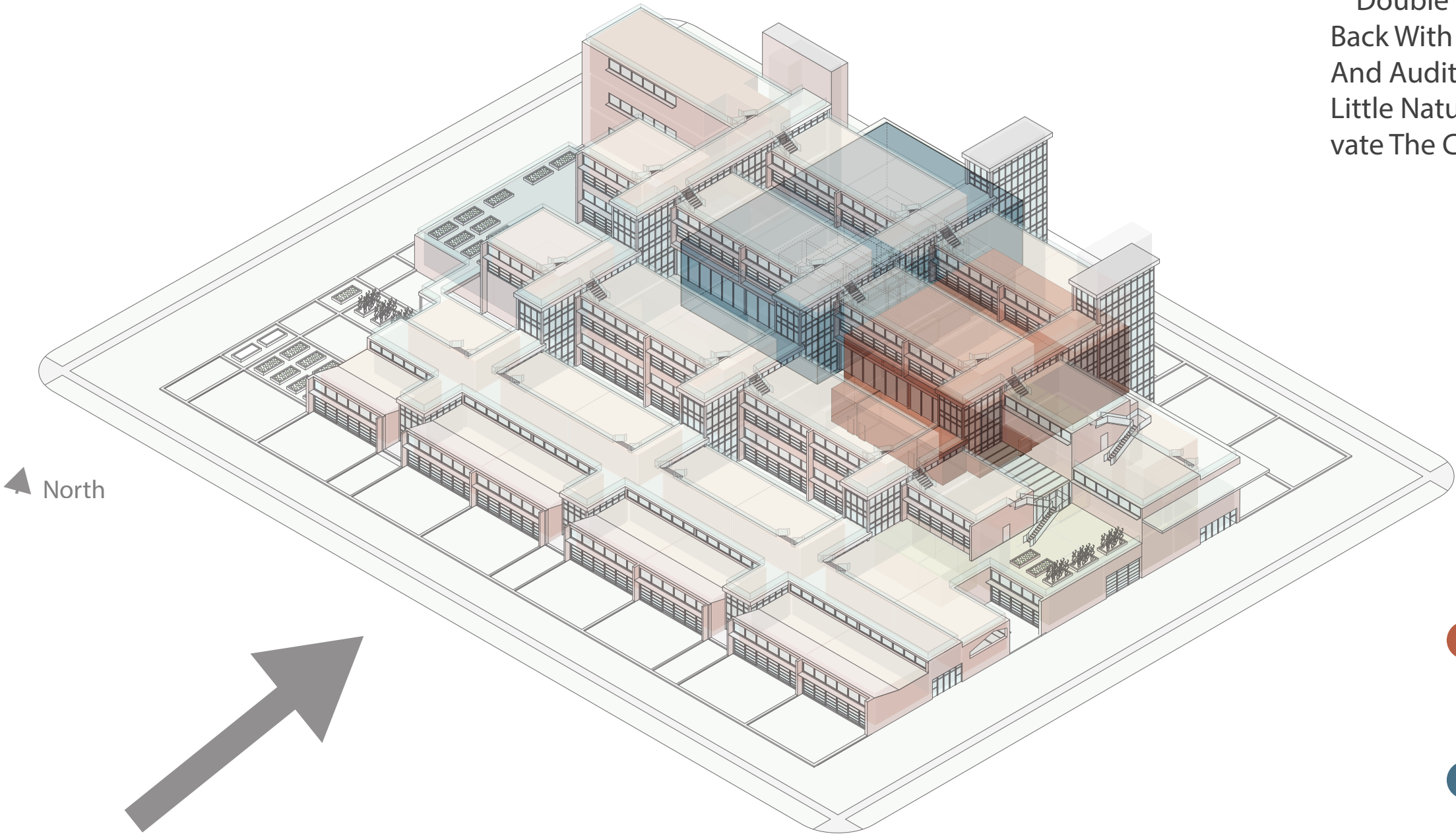
# Access To Natural Daylight: Classroom Organization Strategies - Gymnasium and Auditorium



Natural Light

## Northern Exposure:

Double Height Spaces Are Tucked Into The Back With Light From The Courtyards. The Gym And Auditorium Were Ideal Because They Need Little Natural Light And Provided Height To Elevate The Classroom Spaces Out Of Shadows



Auditorium - Host Performances, Theater, and Parent/Community Meetings



Gymnasium - Sports Activities And After School Programming

## Access To Fresh Air And Ventilation:

Programatic and Concienscious Influences On Design



Fresh Air

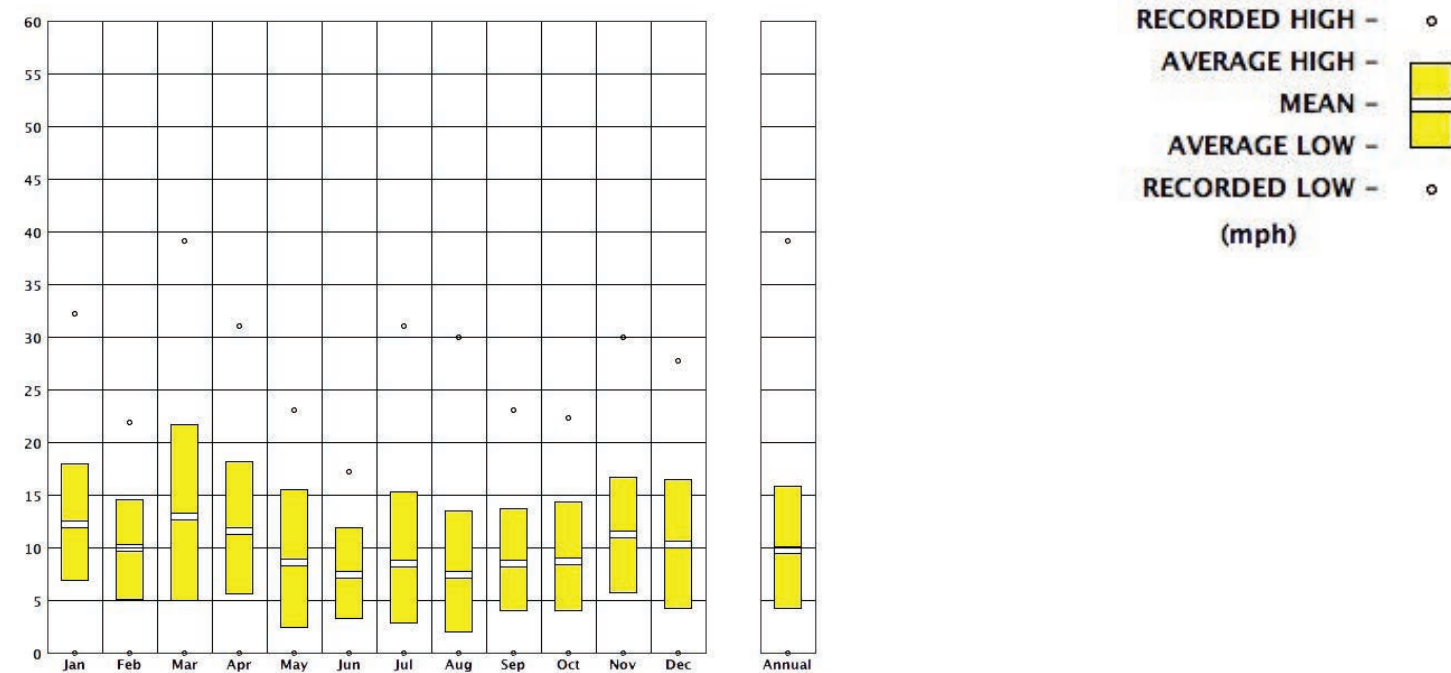
# Access To Fresh Air And Ventilation:

## Syracuse NY Climate Conditions



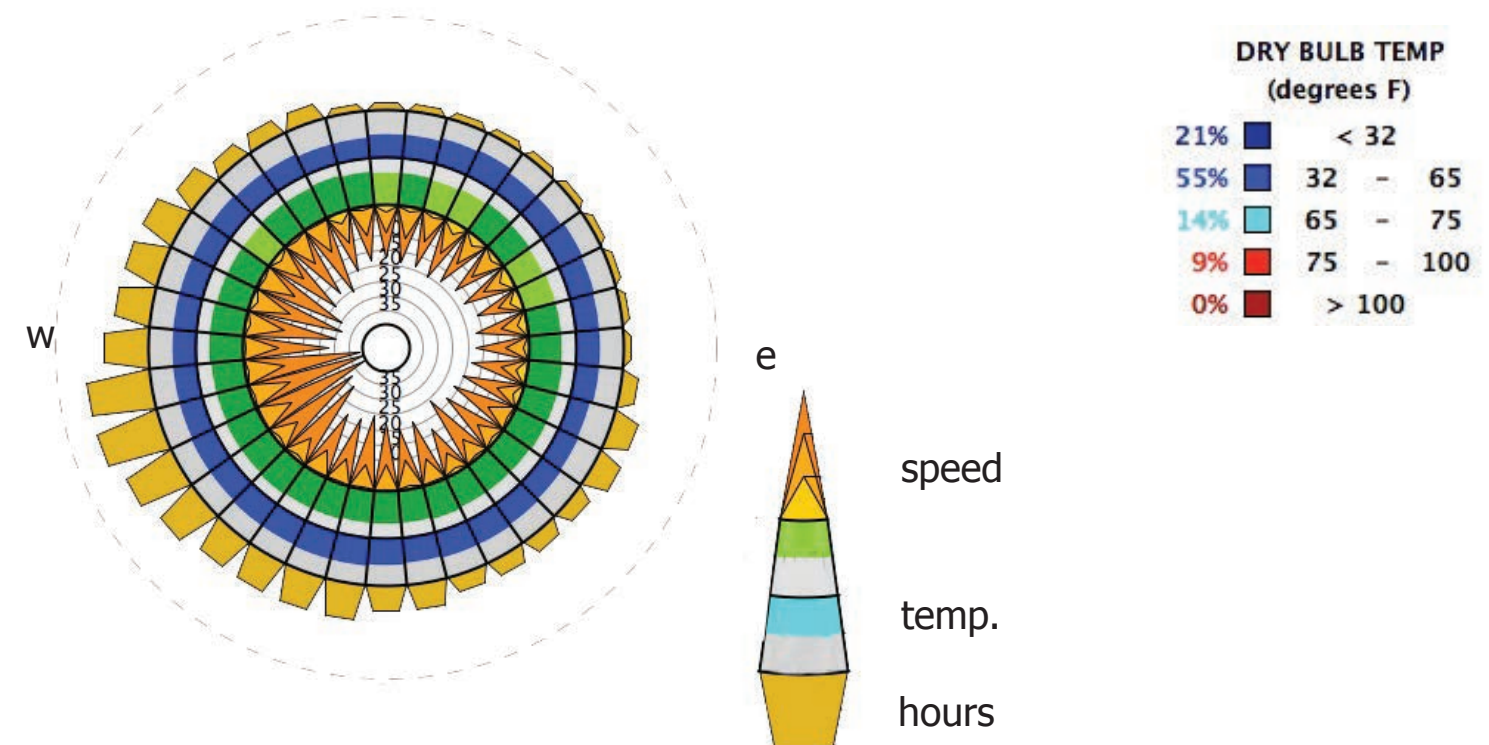
## Climate Considerations For Fresh Air and Ventilation:

# Wind Velocity



Wind velocity is greatest in March and least in June. This could pose a problem in the summer using cross ventilation as the primary cooling method but since the building will be largely uninhabited during the summer months, this will only be a concern in a few areas. Winter winds average around 12 mph.

# Wind Rose



Wind on the site according to this wind rose approaches from the west. To keep the cold winter winds at bay, evergreen plants can be utilized on the west end of the site to cut the wind and act as a buffer.

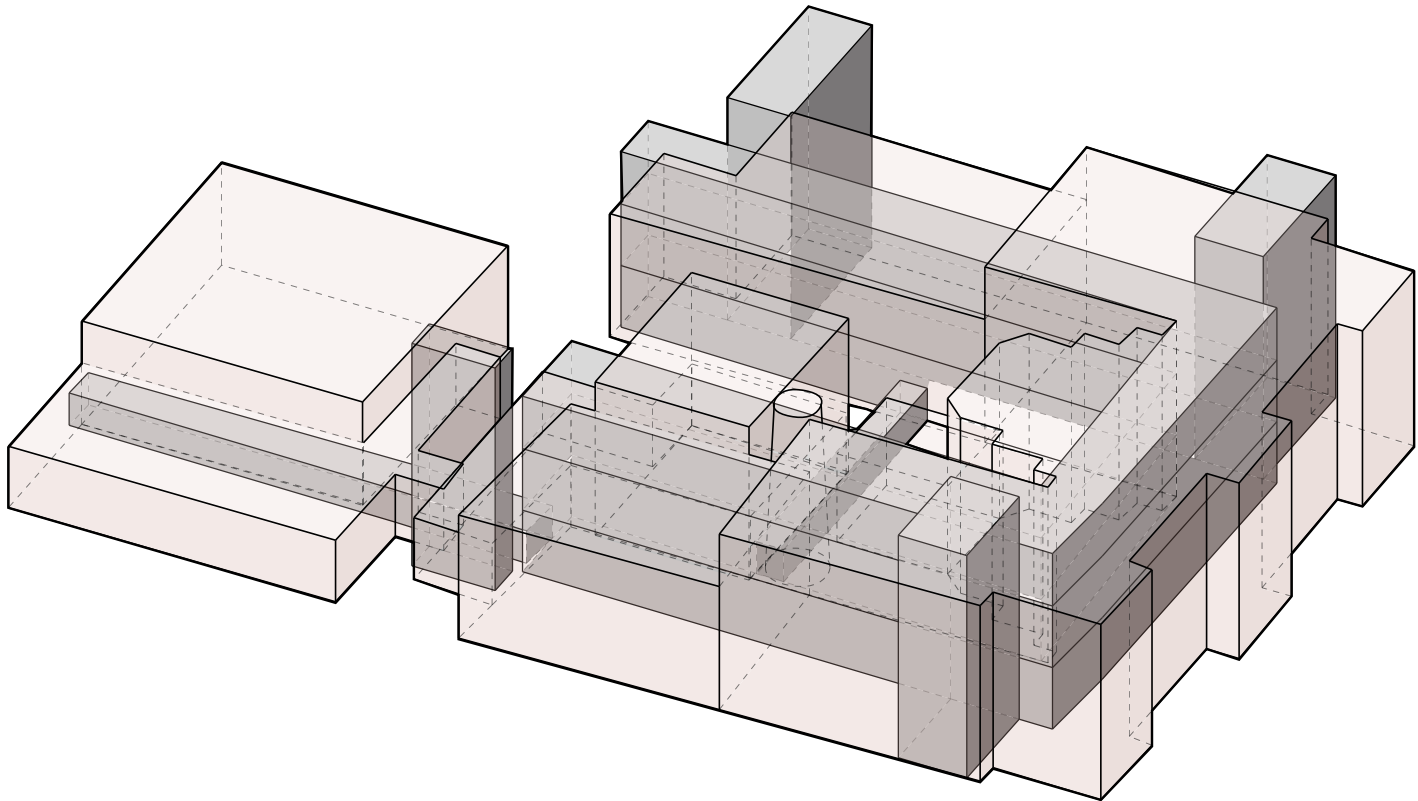
# Access To Fresh Air And Ventilation:

Comparison - Existing Building - Circulation



Fresh Air

Blodgett Middle School is an old, traditional school building. The construct concribes to a U-shaped morphology in which the cooridor spaces wrap the interior of the building pushing hte classes to the exterior walls of the U. Circulation cores are found at four points offset from the corners allowing as many spaces as possible to have two exterior surfaces. The lowest level main-tains a double loaded corridor.





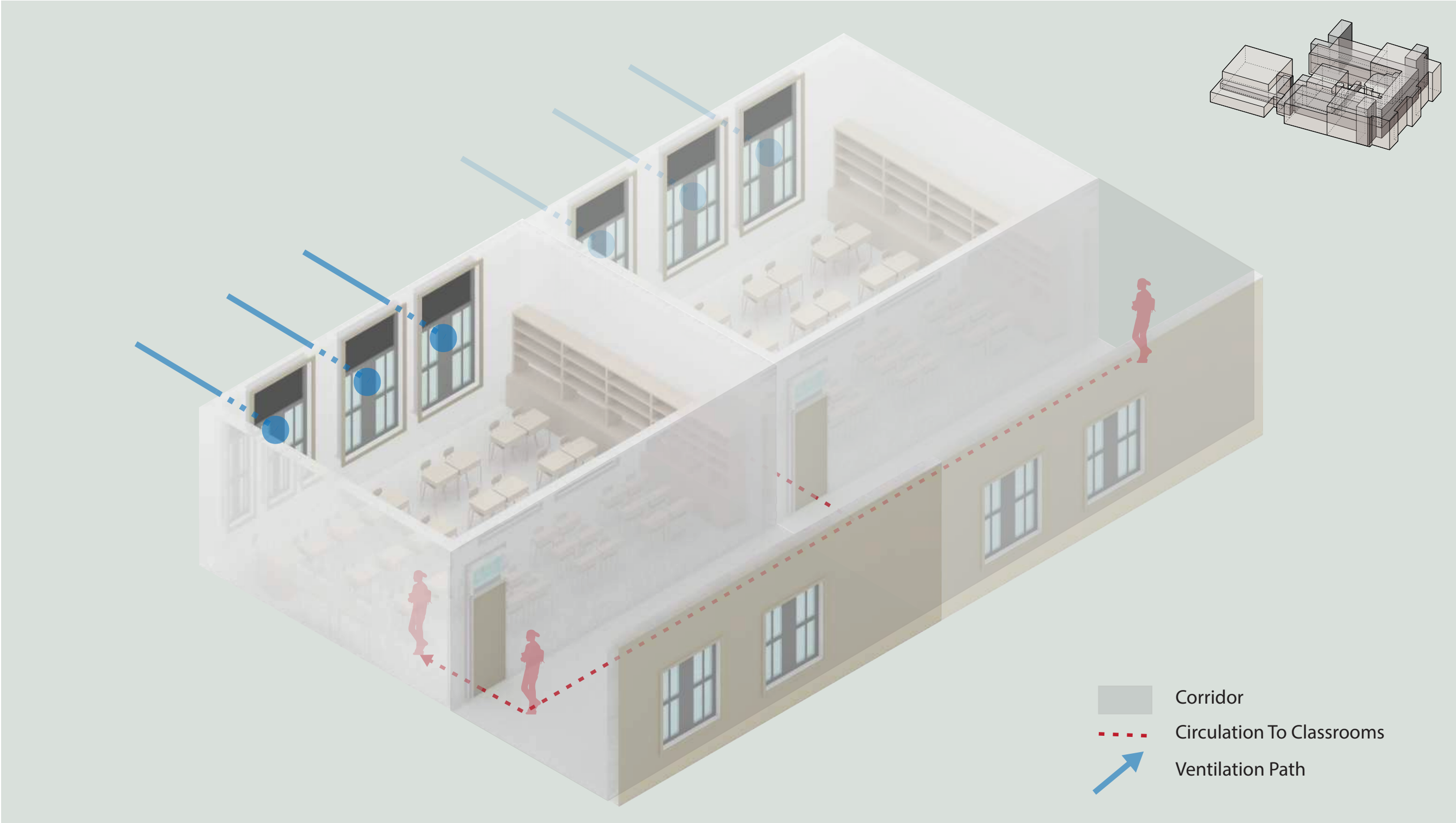
# Access To Fresh Air And Ventilation:

## Comparison - Existing Building - Classroom Circulation



The circulation path of Blodgett Middle School as it exists snakes around the interior of the U-shaped parti of the building. Classrooms are accessed from this internal corridor.

The only available apertures consequently are on the outer edges of the U-shaped building. this can have negative effects on the flow of air into the classrooms.



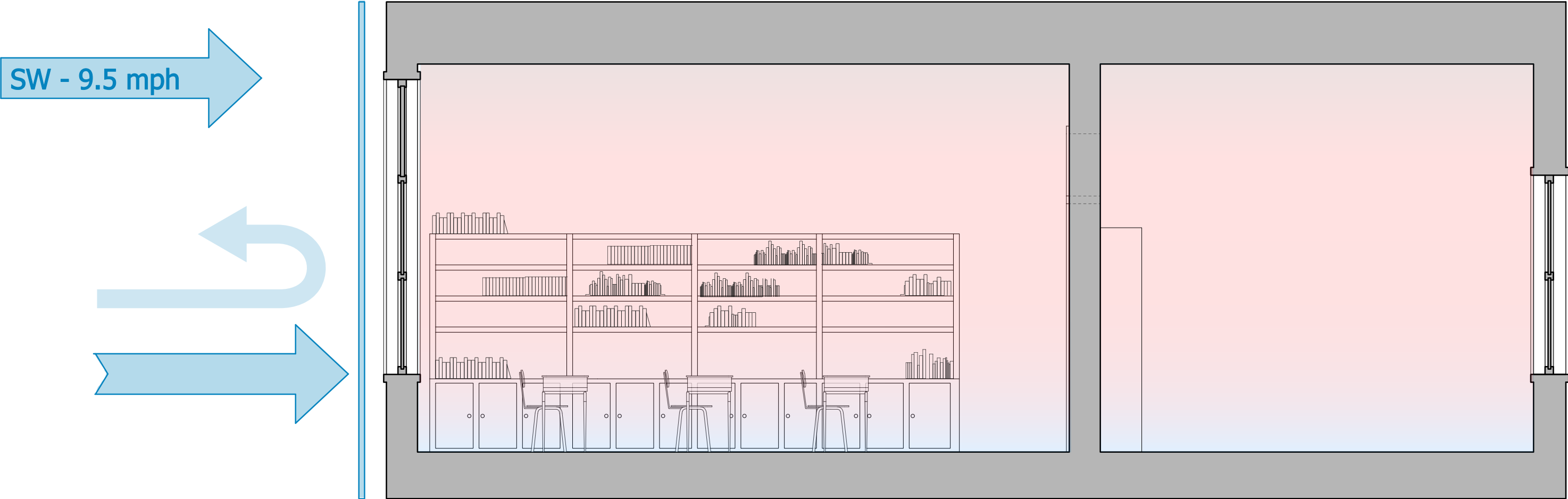
# Access To Fresh Air And Ventilation:

## Comparison - Existing Building - Classroom Ventilation

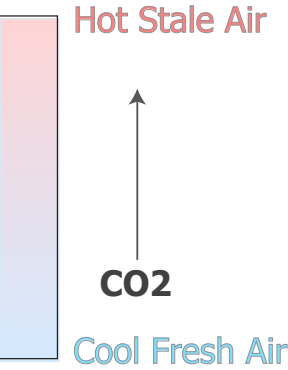


Cross-ventilation is prevented in the existing Blodgett Middle School Due to the Traditional U-shaped morphology of the building. Air is only able to enter the room from one side of the classroom because the adjacent corridor

prevents additional aperatures. As such, there is not outlet for the air so the path of air is blocked preventing adequate ventilation. This can create a build up of warm stale air that is rich in CO<sub>2</sub>, decreasing student attention and health



Air Levels:

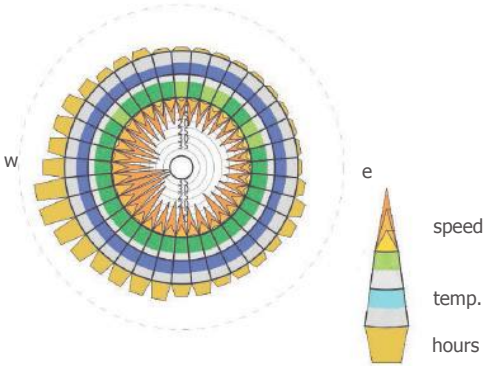


Predominant Wind

Direction.....SW - W  
Wind Range.....5-35 mph

Average Wind Speed:

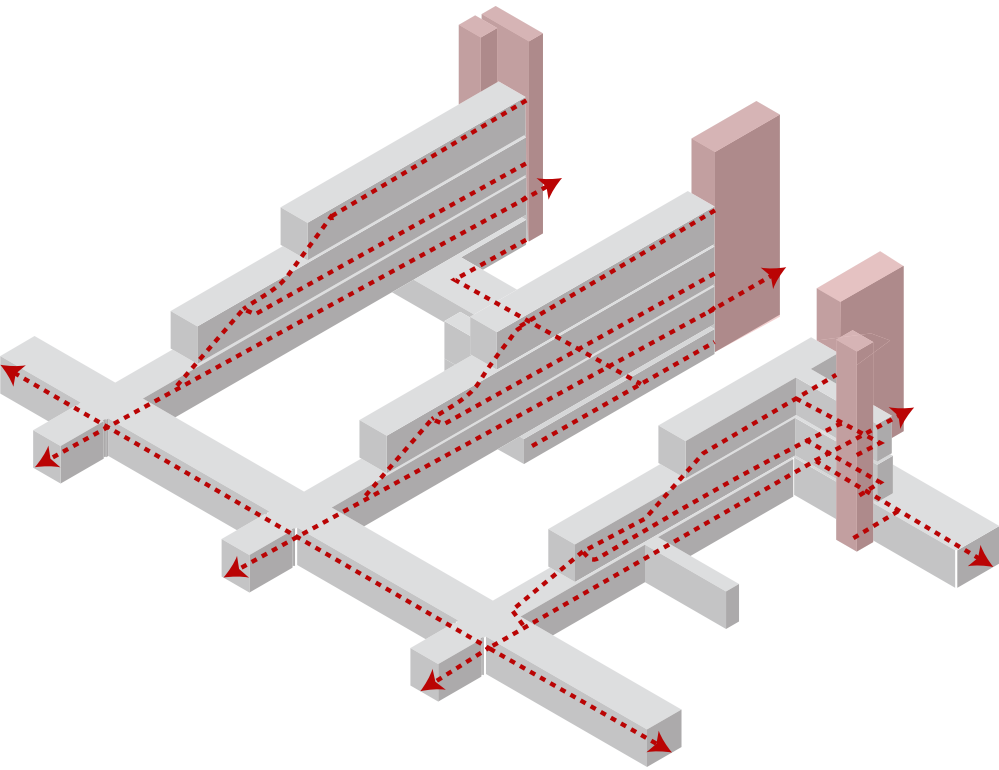
Annual Mean.....	9.5 mph
Spring.....	10 mph
Winter.....	12 mph
Fall.....	9 mph



# Access To Fresh Air And Ventilation:

## Comparison - Proposed Building - Circulation

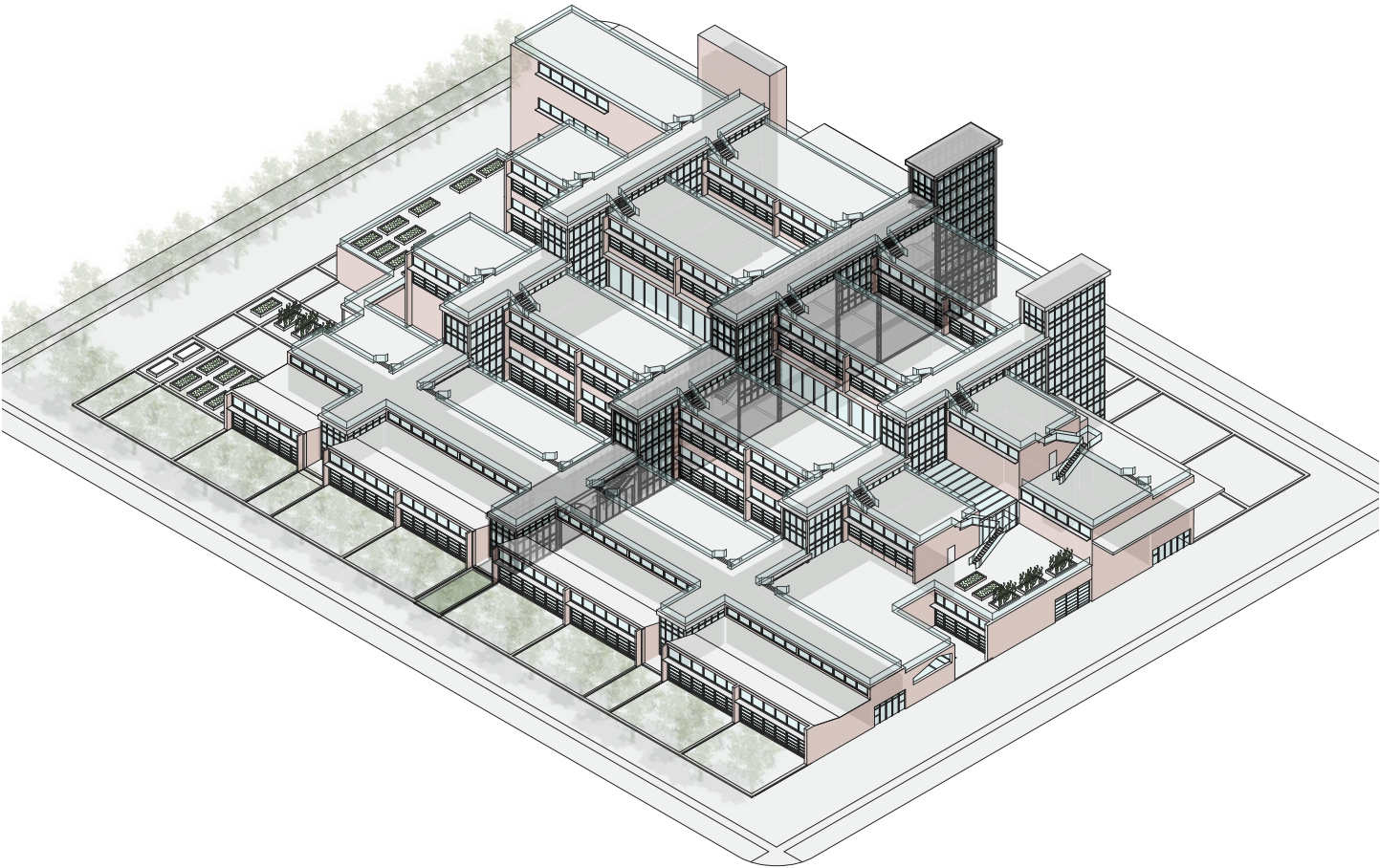
The proposed Blodgett Middle School utilizes circulation patterns as a tool by which every classroom can be provided with cross ventilation with predominant wind in-puts from the South and West to accommodate the Southwestern winds. In order to achieve this, a single corridor is created perpendicular to the classrooms with three fingers of circulation branching off of this corridor to allow side entry into three levels of teared classroom spaces. This allows for more circulation and greater levels of oxygen in the classrooms which can improve alertness, attention, and respiratory health.



..... Primary Circulation



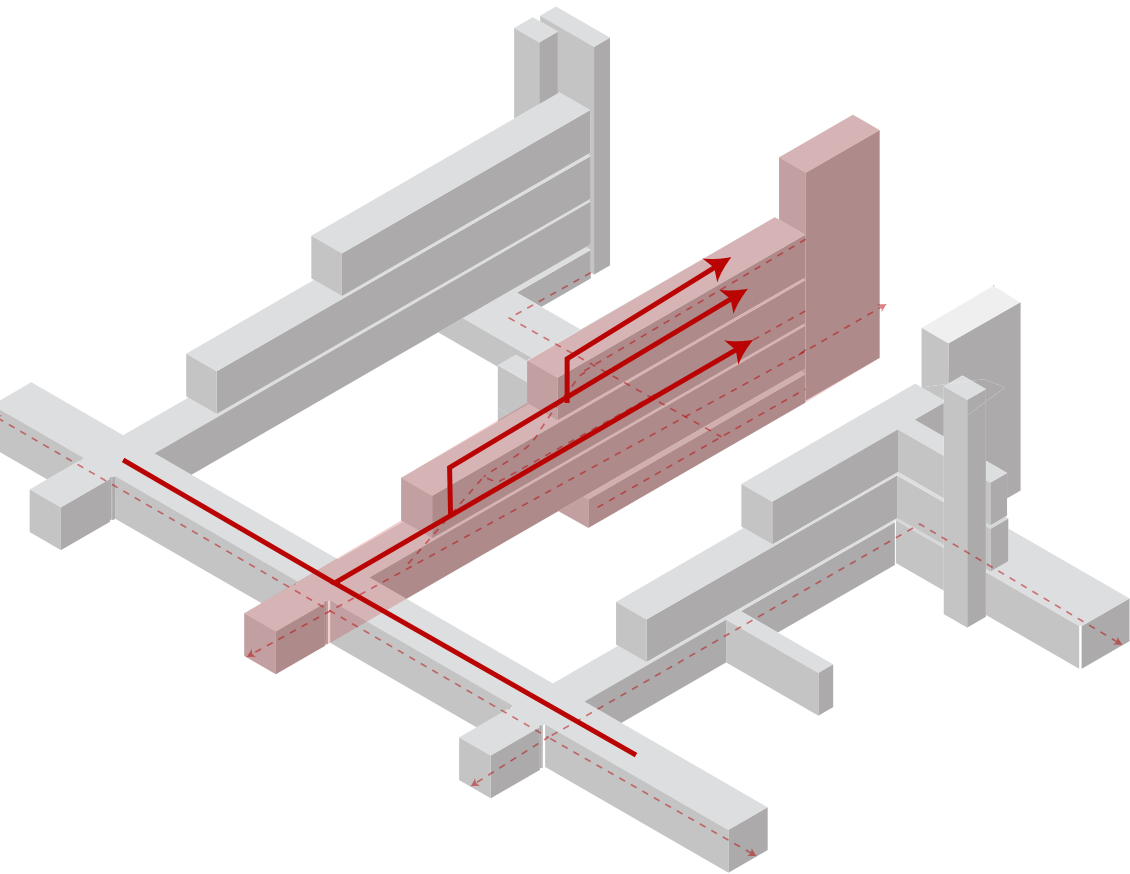
Gray toned circulation with one circulation finger highlighted. This represents the path to the classrooms.



# Access To Fresh Air And Ventilation:

## Comparison - Proposed Building - Circulation

The role of circulation in the design of cross ventilation is best observed through the inspection of a single strand of circulation. The building steps up as it reaches farther north providing three main levels for education. Students access the three strands from the primary corridor connecting the three strands. From these strands or fingers of circulation, the second and third floor can be accessed. Emergency egress is provided at the end of each finger. These strands provide entry to classroom spaces on both the East and West sides of the corridor.

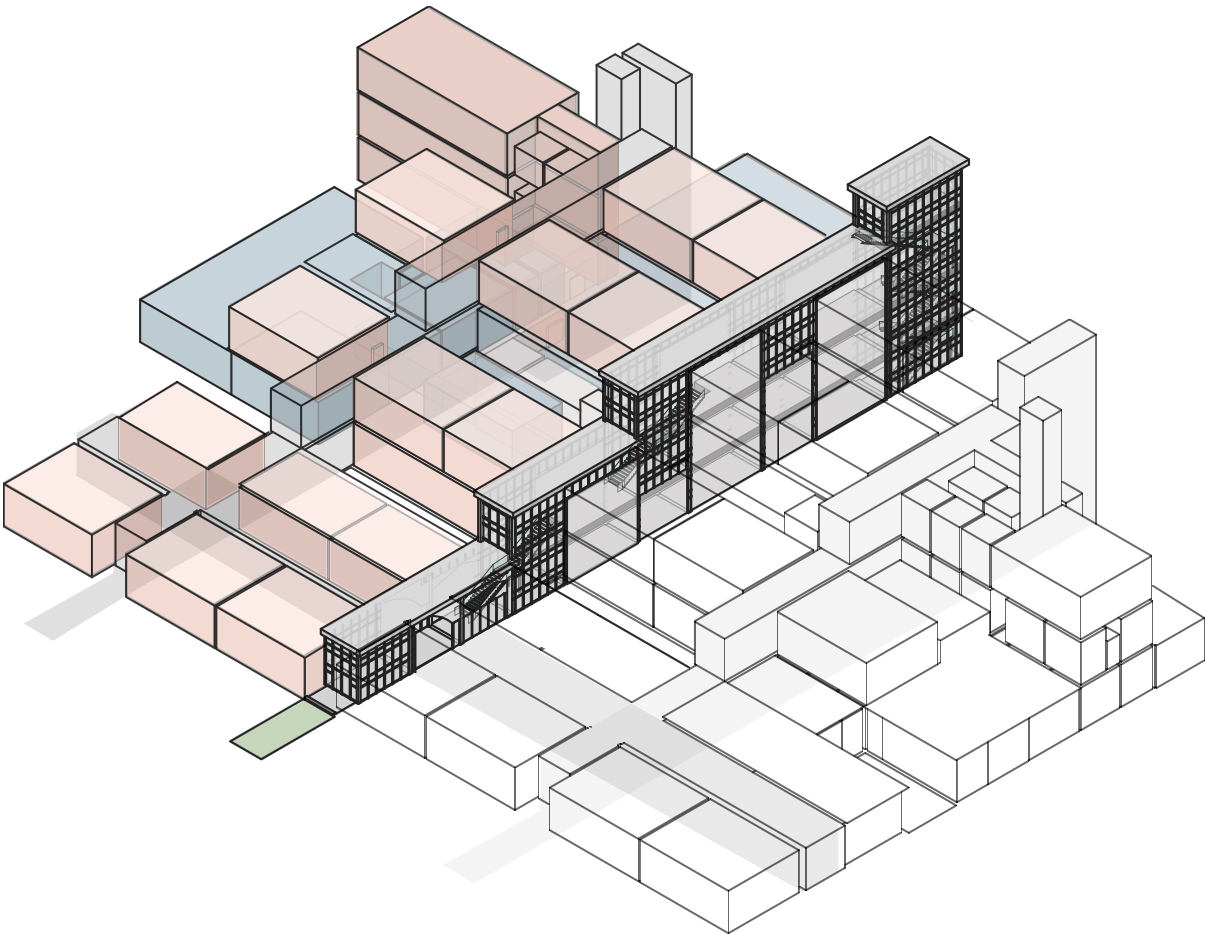


— Circulation Strip - Primary



Fresh Air

Below demonstrates the central strand of circulation in relation to the programmed spaces. the pink toned boxes represent the classroom spaces to be accessed.

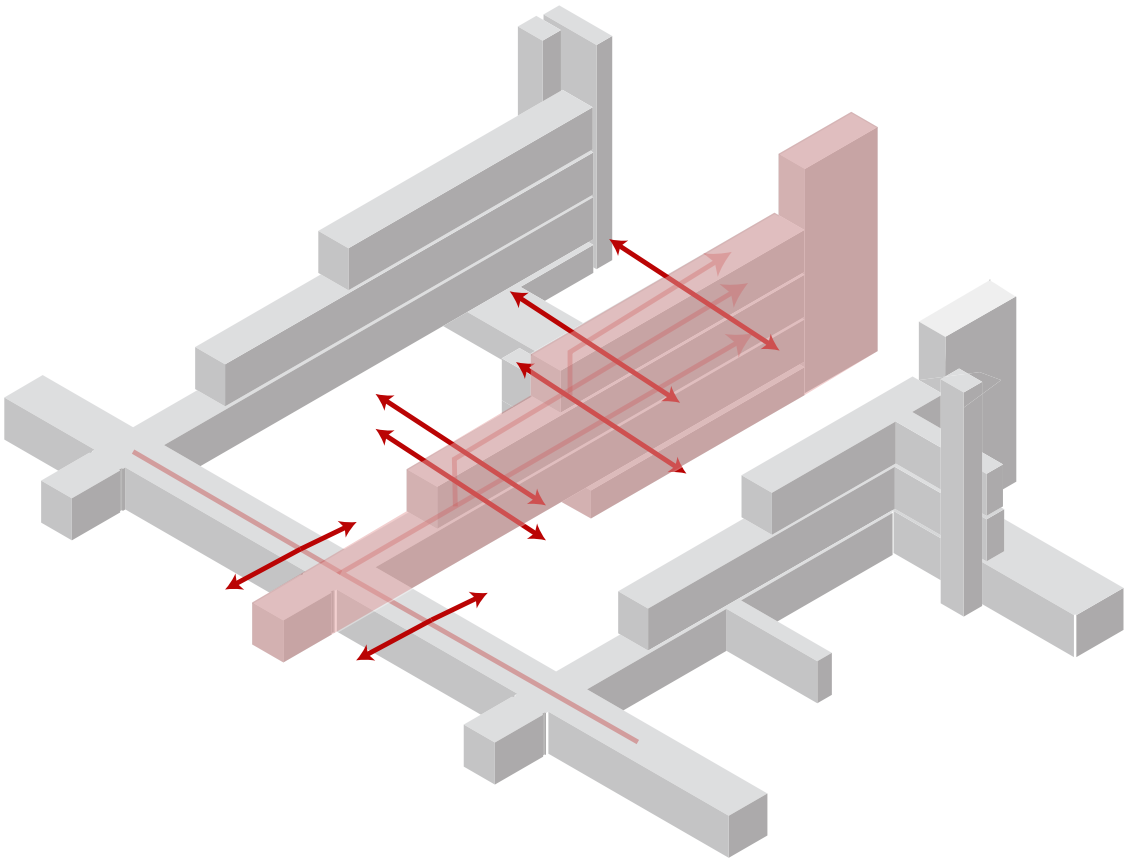




# Access To Fresh Air And Ventilation:

## Comparison - Proposed Building - Circulation

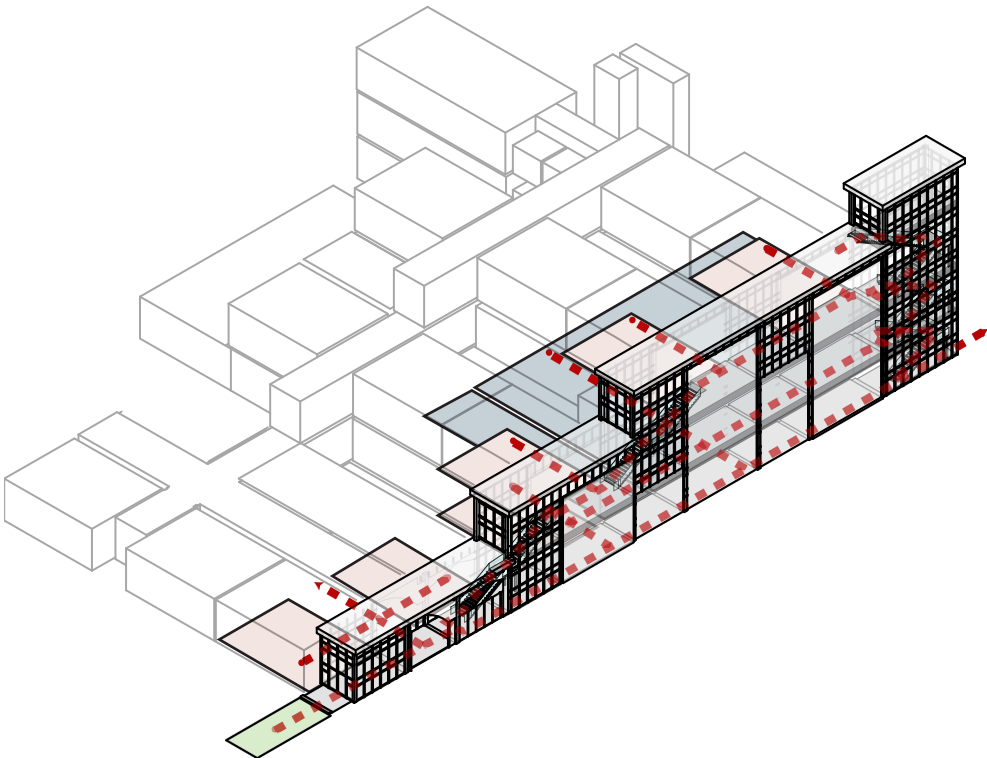
Accessing the classrooms from the side of the room leaves the long edges free for operatures. Minimizing circulation paralell to the classrooms provides better ventilation with increased area for aperatures.



— Circulation Strip - Secondary Classroom Entrance System



Below demonstrates the circulation into the individual spaces. The circulation strands access the classrooms from the short sides.



# Access To Fresh Air And Ventilation:

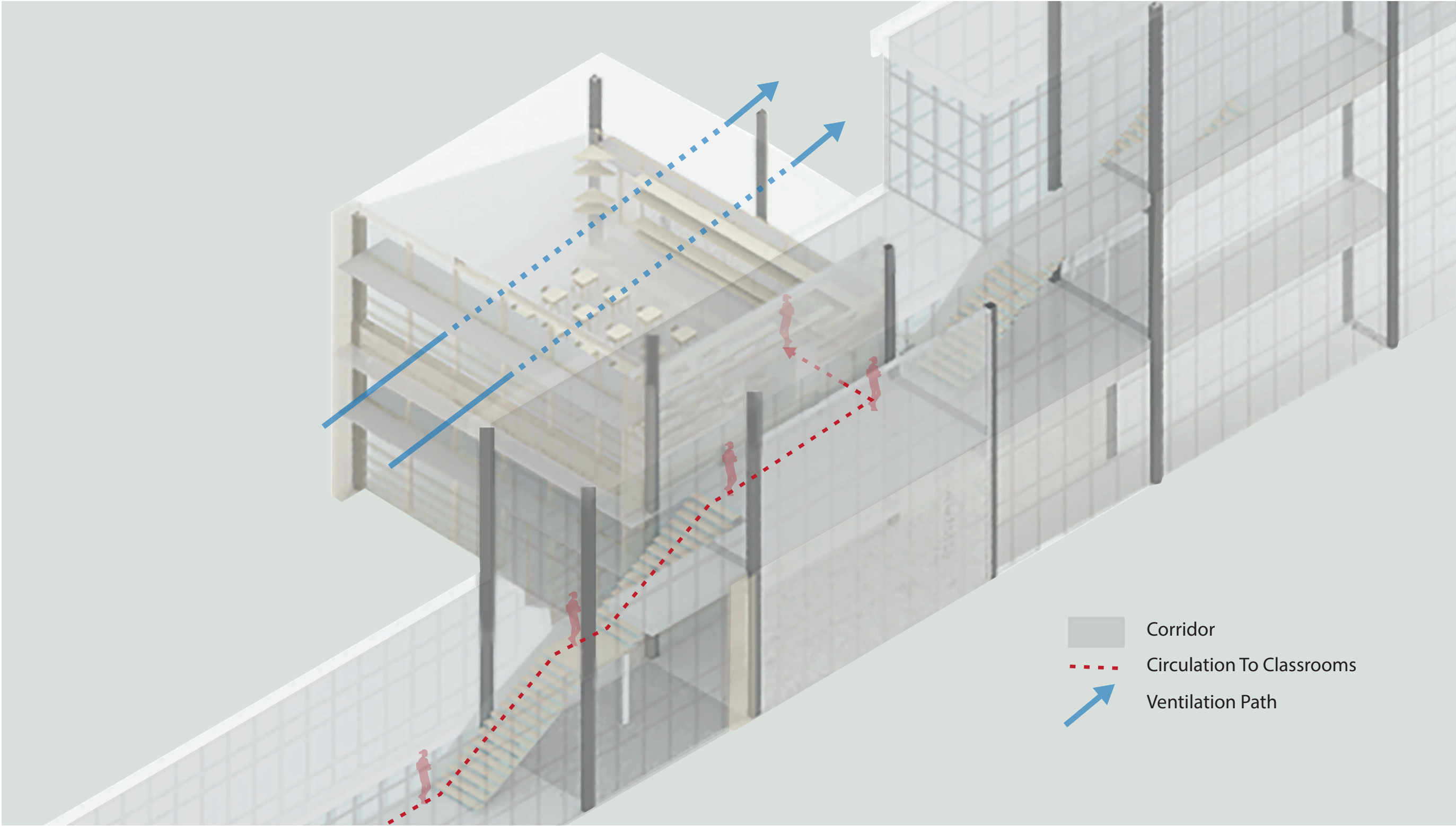
## Comparison - Proposed Building - Circulation



Fresh Air

Below demonstrates how the ventilation and circulation of a single classroom work together.

The displayed classroom is a second story room with Southern exposure.



# Access To Fresh Air And Ventilation:

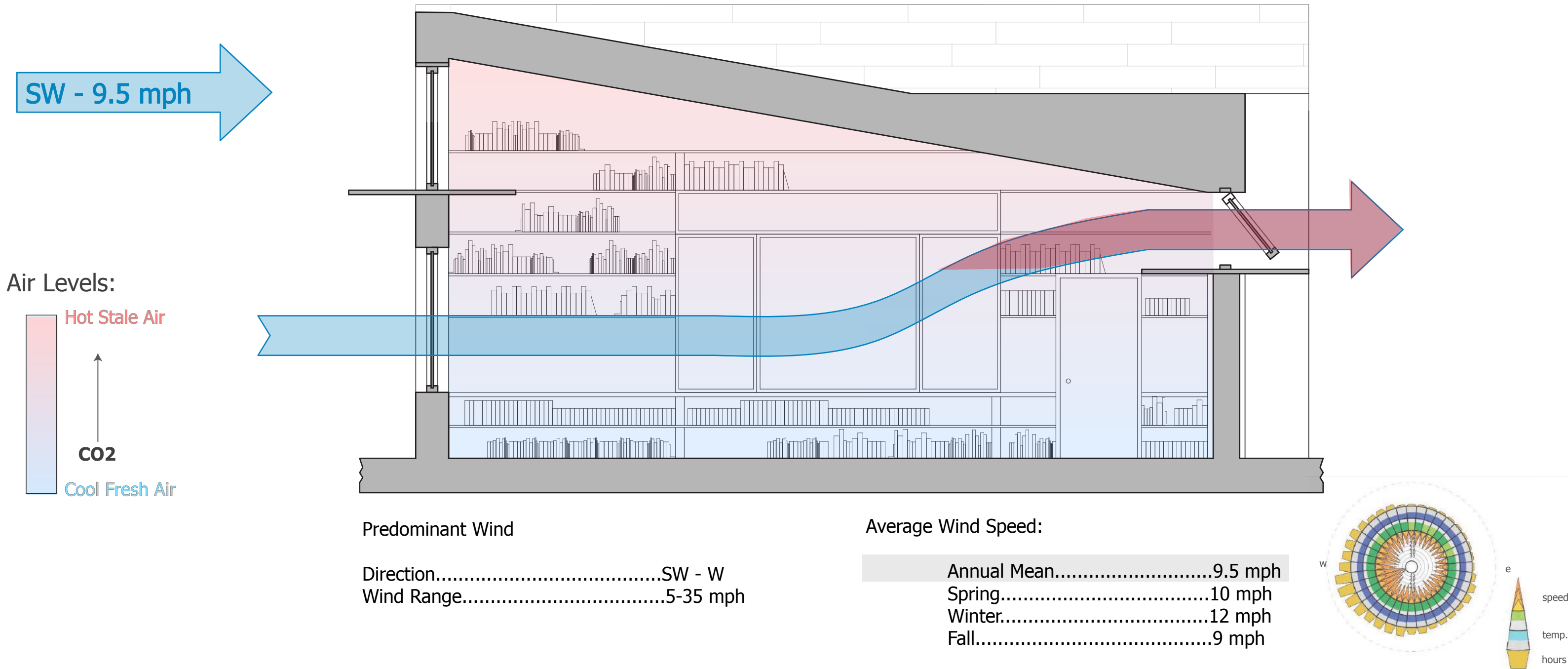
## Comparison - Proposed Building - Unit Ventilation - Typical

The typical classroom in the proposed Blodgett Middle School utilizes air inputs from the South with an average velocity of 9.5 mph. The input is placed low while the out-put aperatures are placed high on the opposite exposure.

This forces air into the classroom and sweeps the air up expelling the hot stale air that accumulates at the upper portions of the room. In so doing, the CO<sub>2</sub> is removed from the class and replaced by fresh air improving alertness, focus, and resperatory health.



Fresh Air

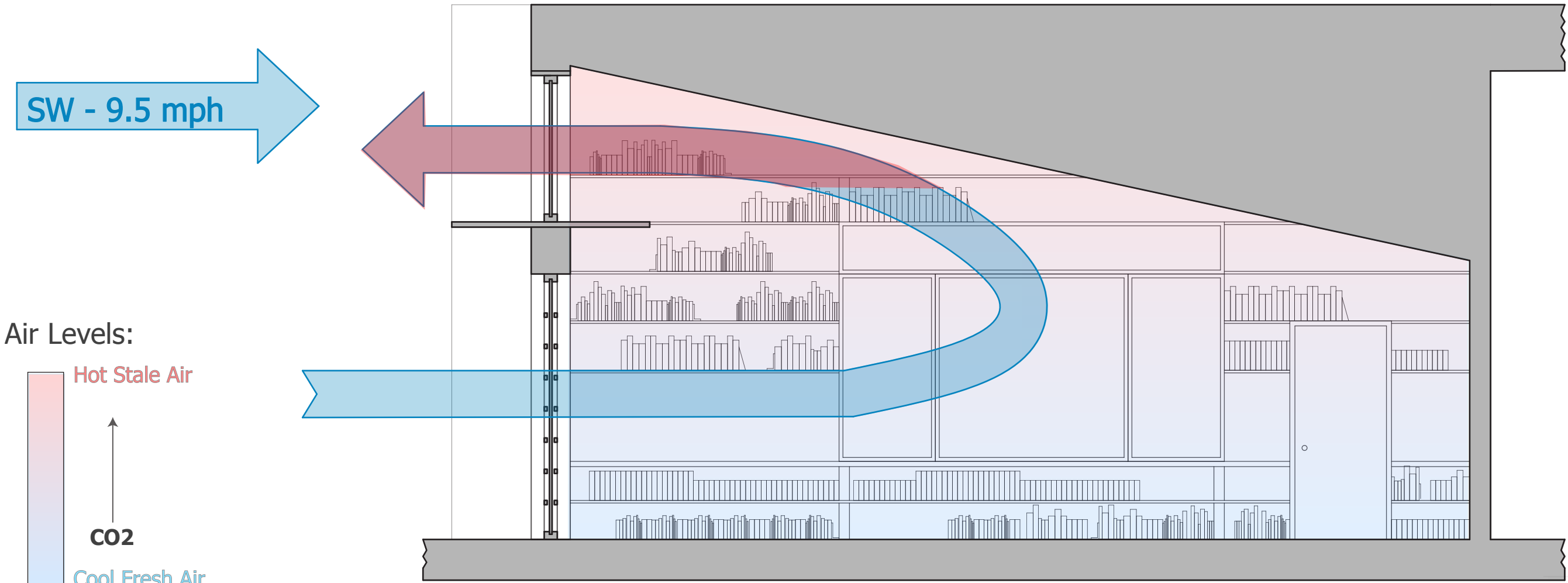


# Access To Fresh Air And Ventilation:

## Comparison - Proposed Building - Unit Ventilation

There are three classrooms in the proposed Blodgett Middle School that do not comply with the typical design. These spaces still utilize air in-puts from the South with an average velocity of 9.5 mph. The input is placed low while the out-put aperatures are placed high. The outputs however are placed on the same exposure as the in-puts.

This forces air into the classroom and sweeps the air up expelling the hot stale air that accumulates at the upper portions of the room from the upper aperature as shown below. In so doing, the CO2 is removed from the class and replaced by fresh air improving alertness, focus, and resperatory health.

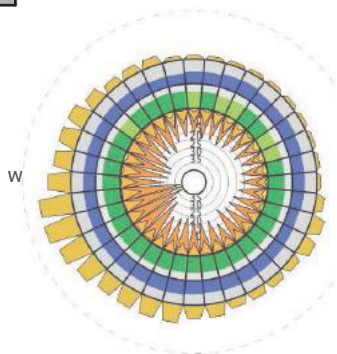


### Predominant Wind

Direction.....SW - W  
Wind Range.....5-35 mph

### Average Wind Speed:

Annual Mean.....	9.5 mph
Spring.....	10 mph
Winter.....	12 mph
Fall.....	9 mph



## Access To Green Space And Vegetation:

Programatic and Consciensious Influences On Design

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Vegetation



# Access To Green Space And Vegetation:

## Existing Conditions

Current conditions at Blodgett Middle School offer students with minimal access to outdoor space and vegetation. The primary outdoor physical activity spaces are provided by the fields adjacent to the school building. The site itself offers little recreational use and greenery. The spaces available on site are two playgrounds that would be better suited for an elementary school than a middle school. This creates a need for the relaxation benefits, physical activity opportunities, and provision of fresh air created by vegetated, outdoor spaces.

The addition of green spaces would also add the opportunity for students to utilize aperatures to view the scenery acting as vissual relief which is believed to improve eye strength and concentration. The vegetation can also be used to mitigate light levels in the warmer seasons and act as a buffer between the school and community.

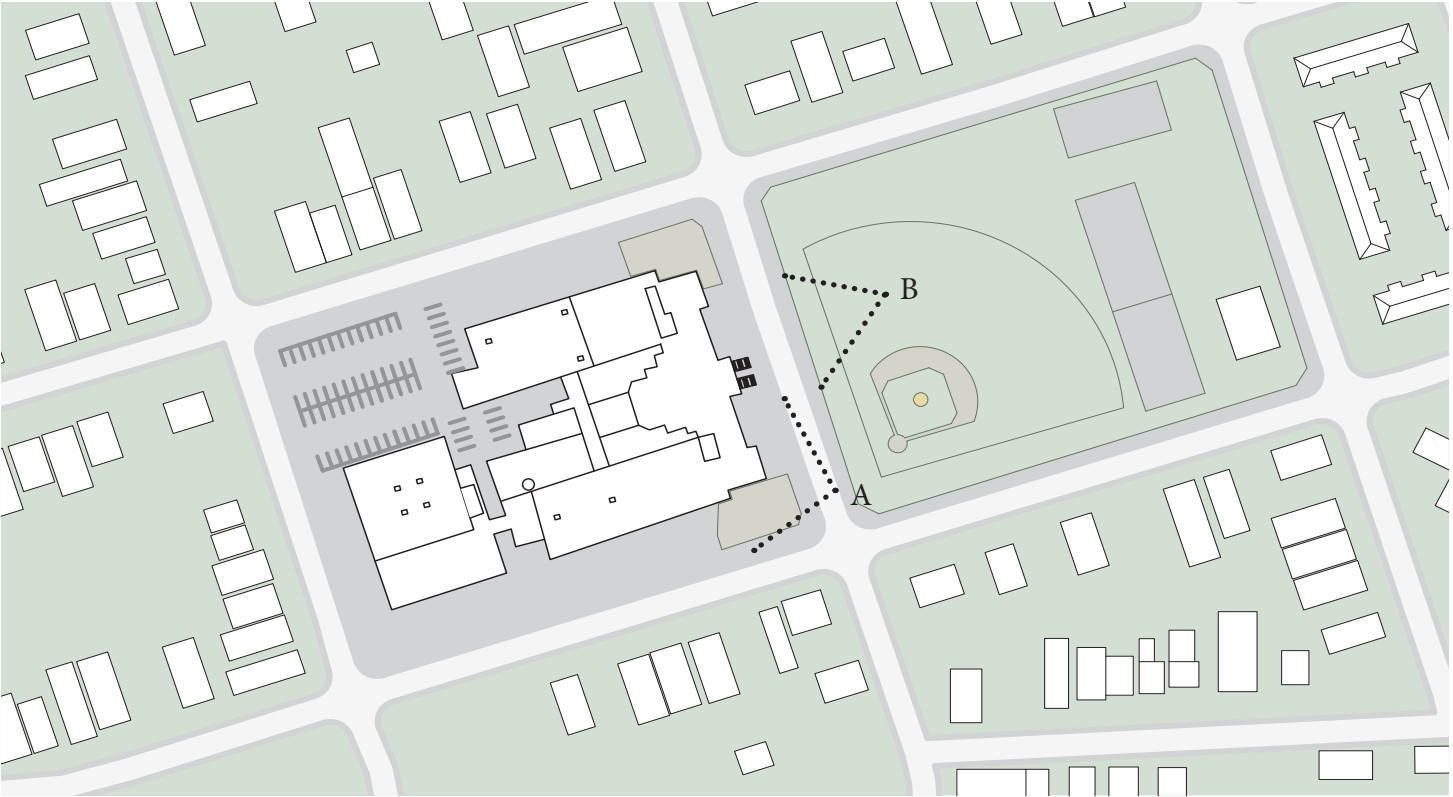
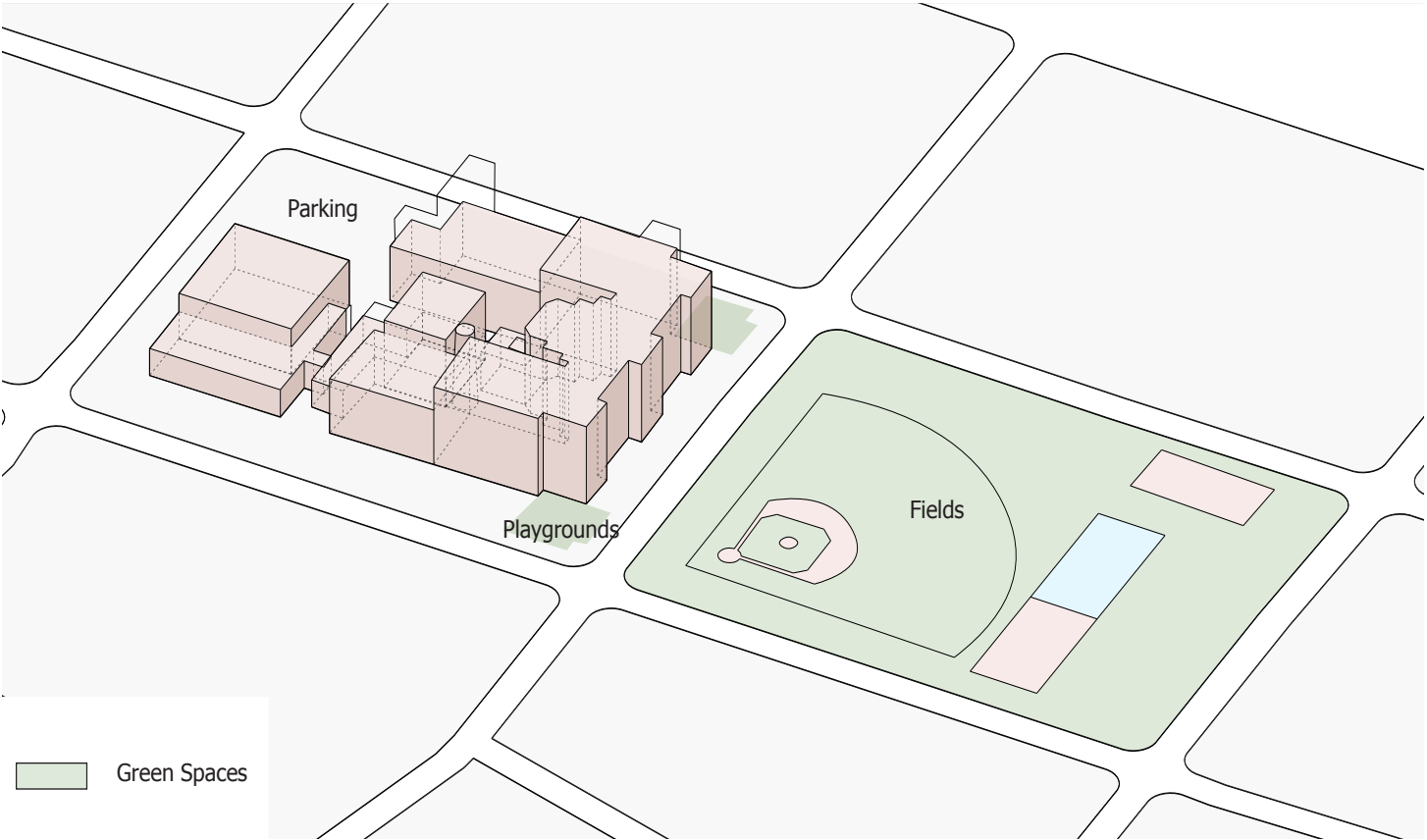
The Blodgett Middle School site currently offers two symetrical playgrounds with a connecting green strip. The rest of the site is utilized for parking



Fields across the street from the school offer community activities and physical activity. These spaces should be maintained.



Vegetation





# Access To Green Space And Vegetation: Proposed Conditions

The new Blodgett Middle School proposal attempts to fully engage the site, offering students and the community the best possible use of the land available to them. The Near Westside of Syracuse NY offers few recreational green spaces. By creating a series of green courtyards and reclaiming the rooftops as green spaces, the students are able to engage the outdoor environment on a deeper level improving attitudes, lighting, and air quality. By creating a visually appealing environment separated from the surrounding environment students are provided with a safe environment for physical activity and social engagement.

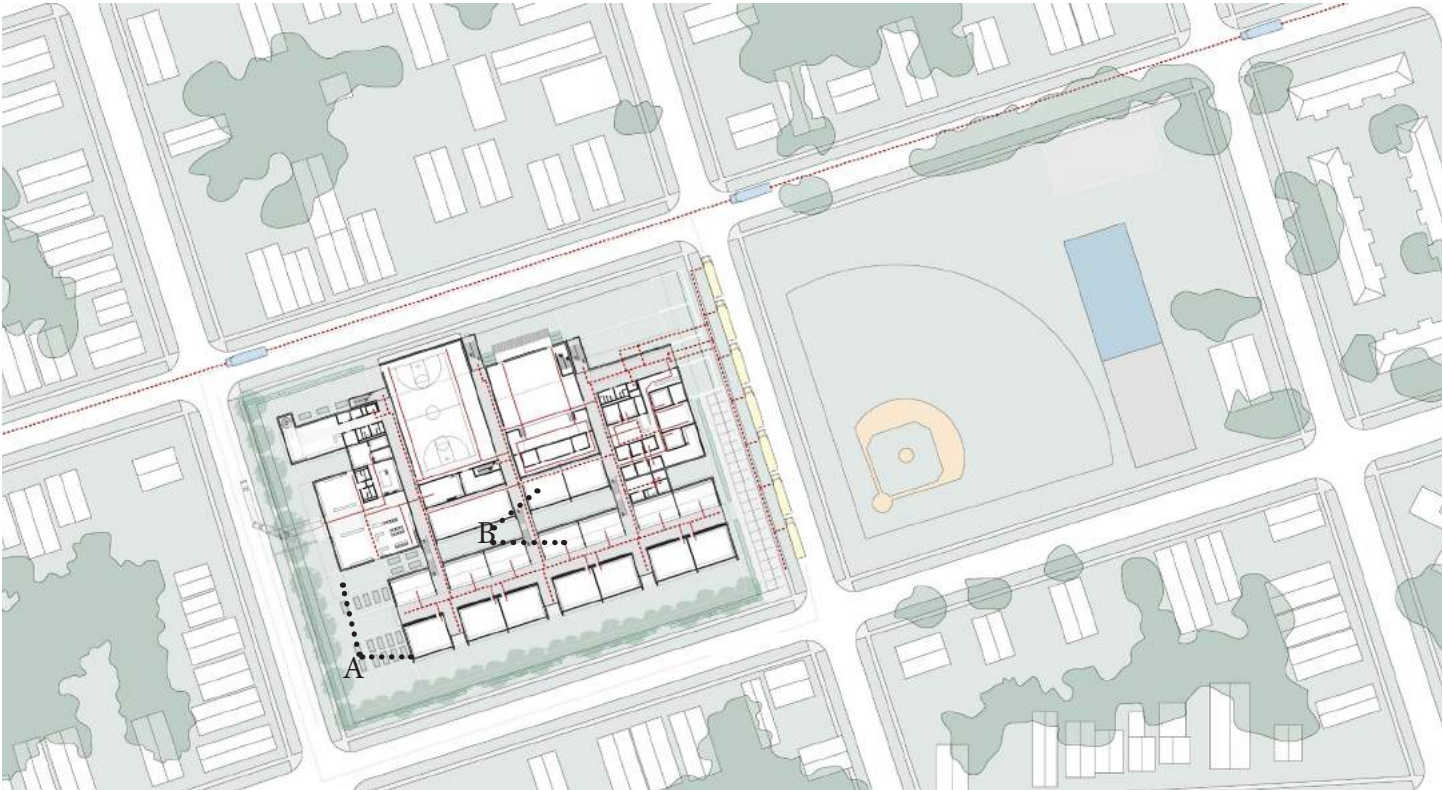
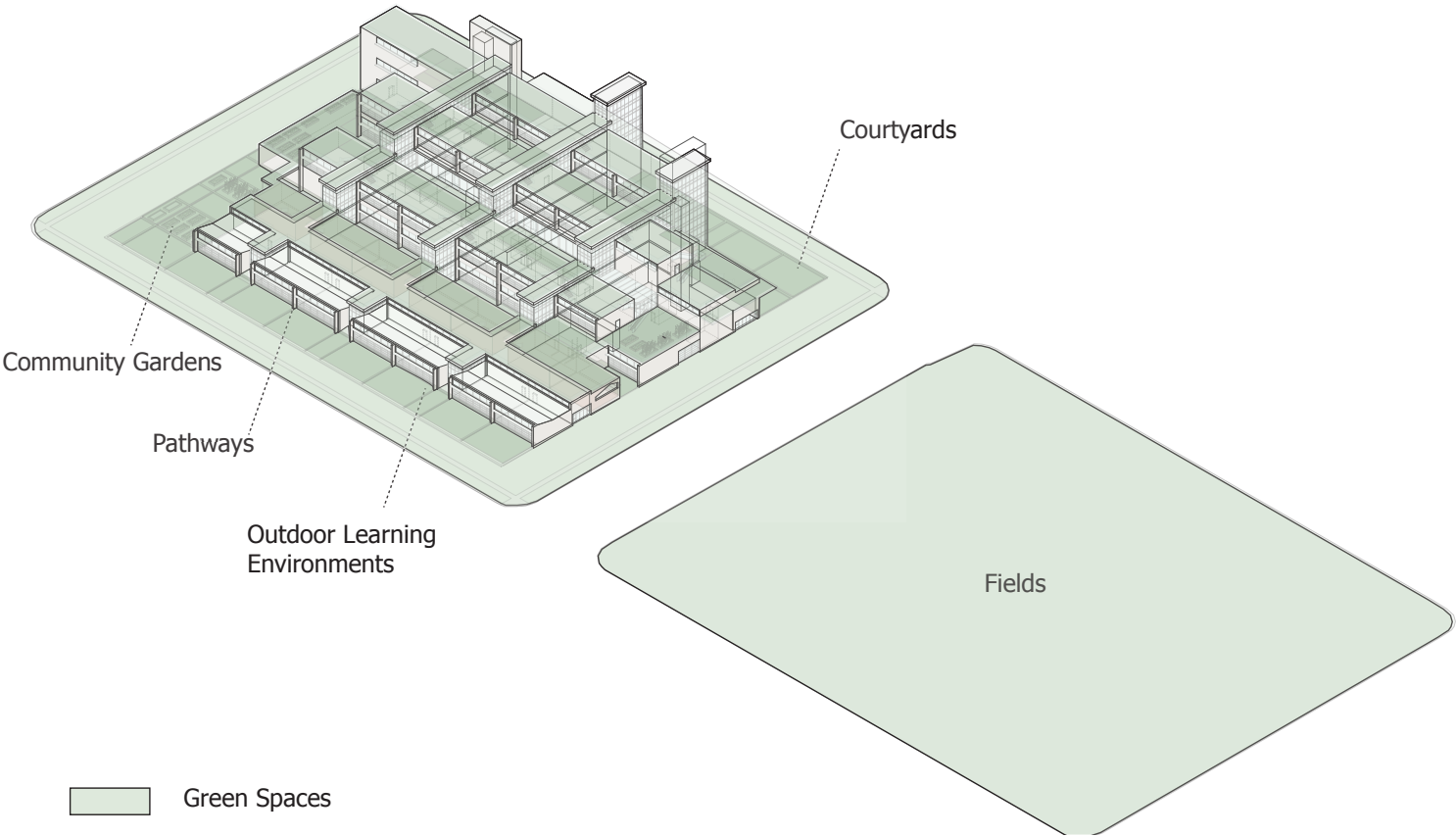
Terraced paths and zones create non-educational outdoor support and recreation spaces for student use.



Educational Courtyards create educational zones for student use and access to light, air, and scenery.



Vegetation



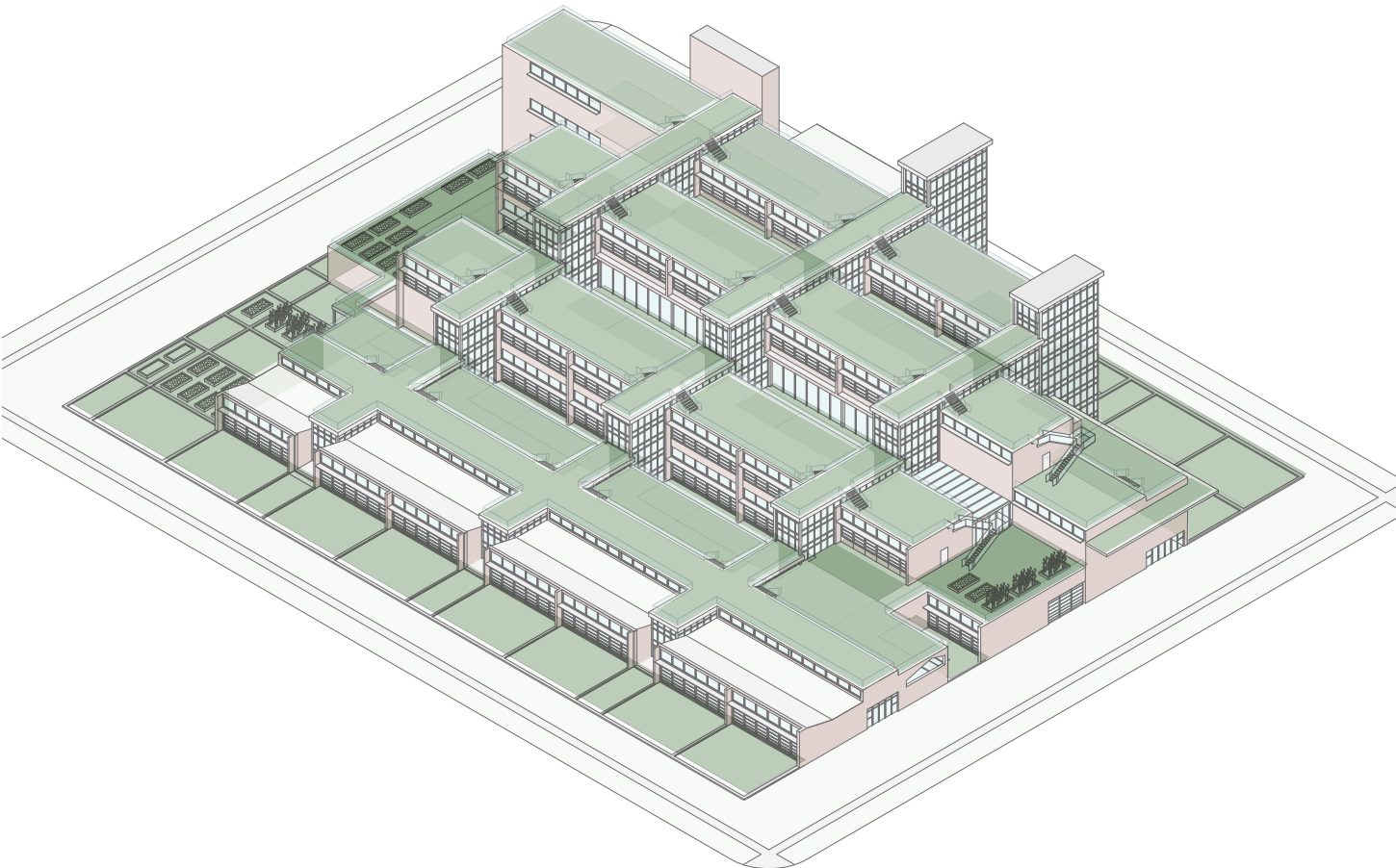
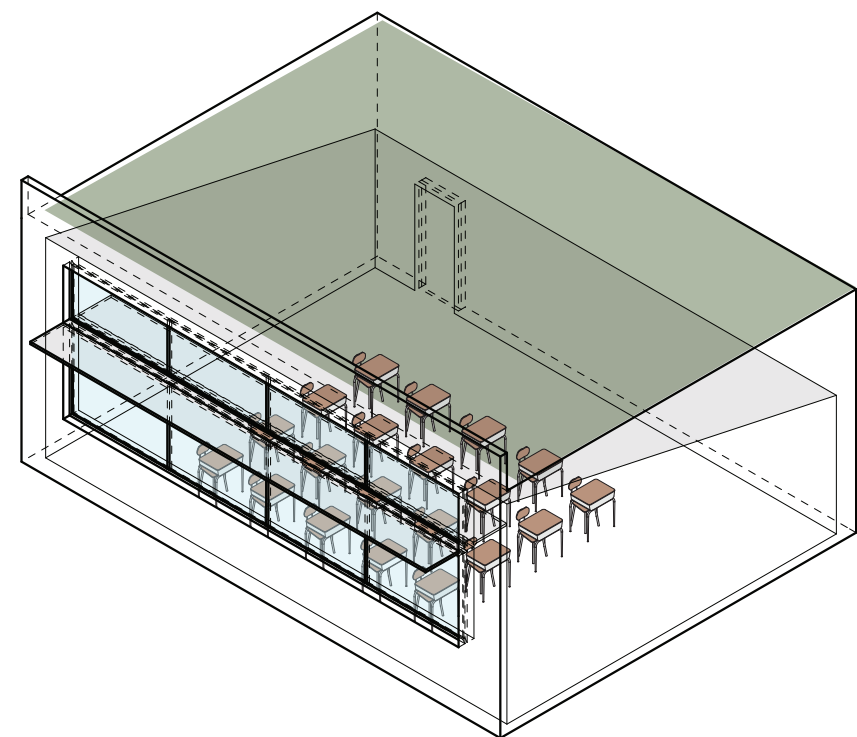


# Access To Green Space And Vegetation:

## Terraced Paths & Recreational Zones - Outdoor Resources

There are two types of green spaces incorporated into the new Blodgett Middle School design: non-educational terraced paths / zones and educational courtyards. The first, terraced paths and zones is intended to serve recreational needs supporting exterior cafeteria programs, community gardens, additional outdoor gym spaces, and recreational areas for students, parents and the community at large.

These outdoor space provide vegetation, improve are quality, buffer the school yard from the surrounding area to ensure a relaxing non-distracting educational environment, physical activity, and comforting views. The outdoor terraces utilize walking paths, study areas with benches, gardens, and outdoor dining areas.



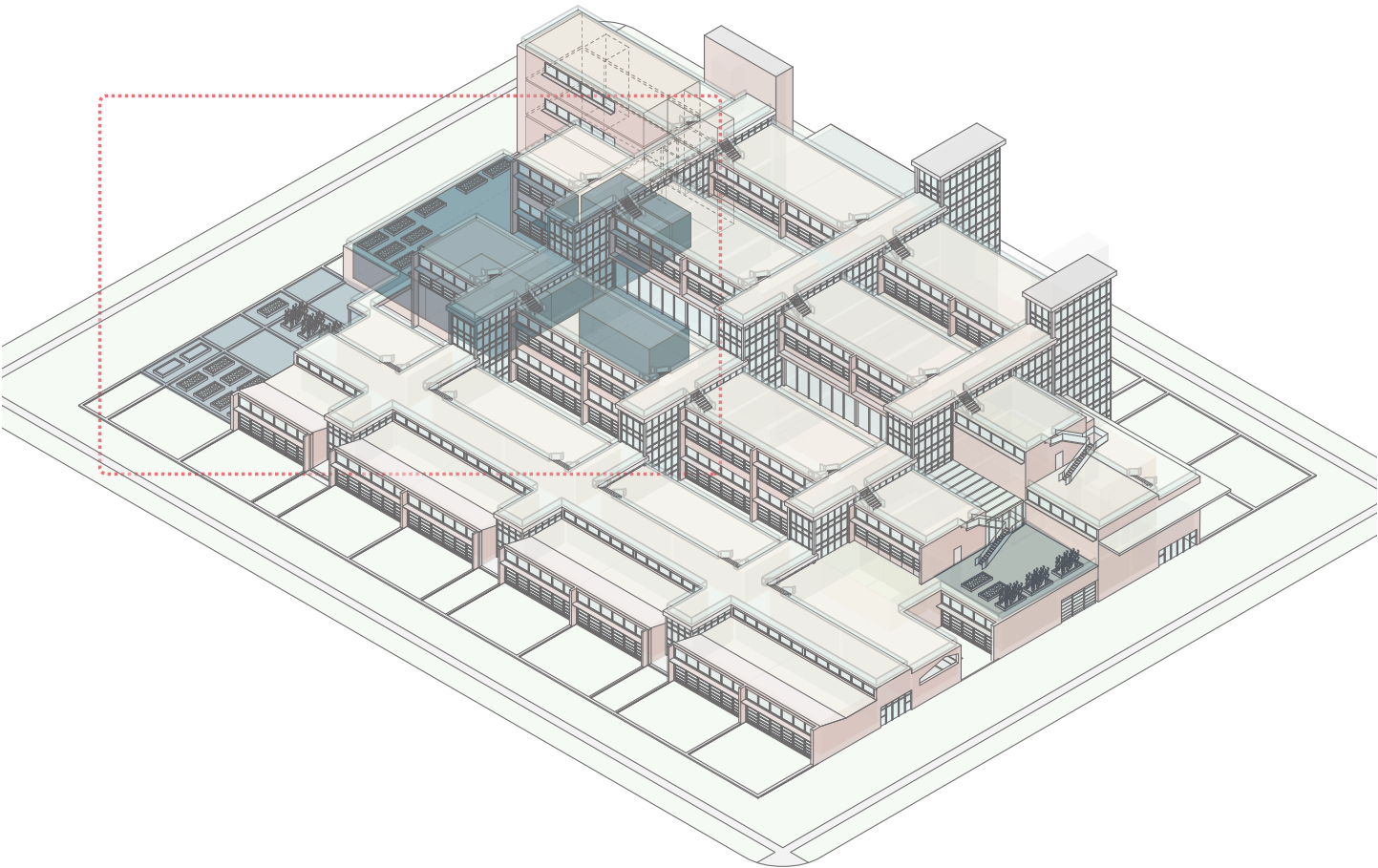
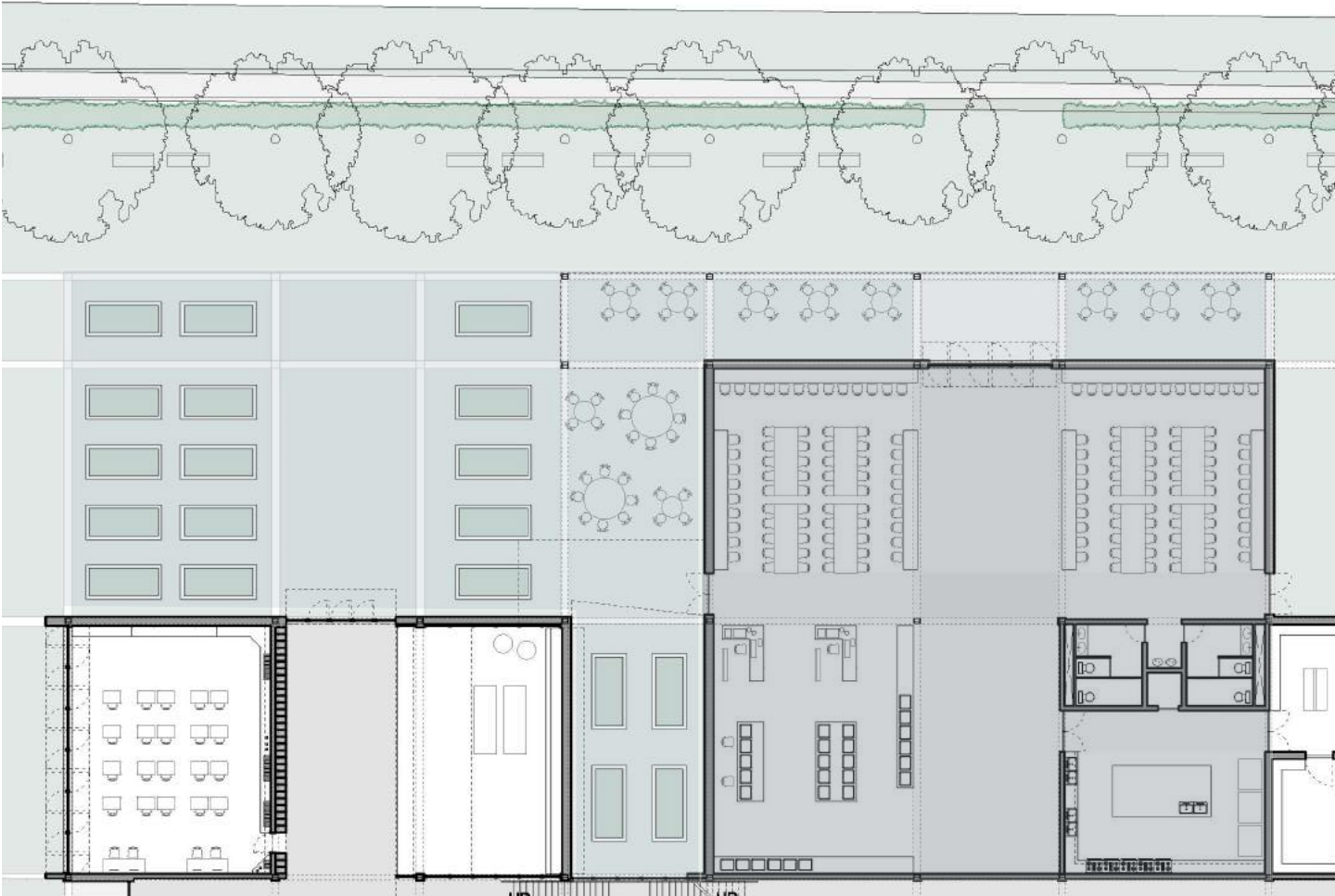
The terraced, noneducational outdoor spaces utilize the building rooftops and side yards of the school to ensure the full utilization of the Schools site while preserving green spaces adjacent to classrooms for educational urposes. By placing vegetation and green spaces on the roofs, there is an added level of insulation that increases the overall R-value of the classrooms.



# Access To Green Space And Vegetation:

## Terraced Paths & Recreational Zones - Community Gardens

The terraced path and zone system is organized to set up a number of adjacencies programatically in order to create health supporting relationships. This is Exemplified by the juxtaposition of the cafeteria spaces and outdoor dining areas to the community gardens. The community gardens not only create a pleasant environment that reminds students of the importance of fresh grown vegetables but also provides a supplemental food source. Student grown fruits and vegetables can be utilized in the cafeteria to supply students with improved nutrition. Since these vegetables would be student grown, there would be a greater potential for student enthusiasm in healthy food options. The juxtaposition offers practical and educational value.



- Cafeteria Space
- Community Gardens



# Access To Green Space And Vegetation:

## Terraced Paths & Recreational Zones - Community Gardens



Vegetation

This image demonstrate the type of environment created by the juxtaposition- of outdoor spaces to programatic spaces within the school. Specifically, this image looks at the community gardens, facing the side enterence of the school with the caffeteria to the left. Students are ingaged in the gardening.

In the background, the terraced rooftops begin to appear, offering further oportunities for engagement. These teraces step down towards the south offer- ing yearly light for activities, safety, and vegetation growth.

- ↑  
Air Quality
- ↑  
Mental Relaxation
- ↑  
Physical Activity
- ↑  
Nutritious Food Source and Education



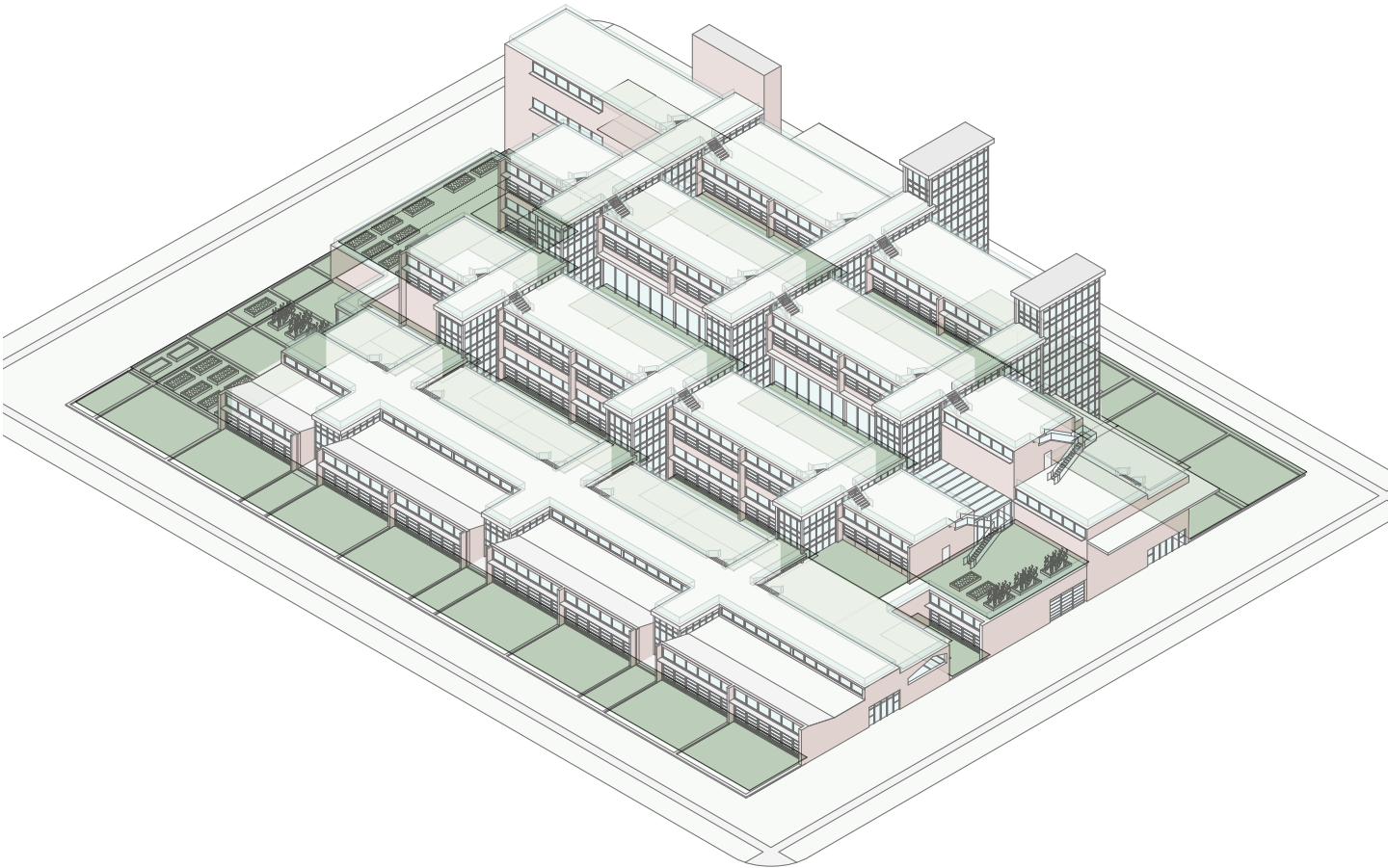
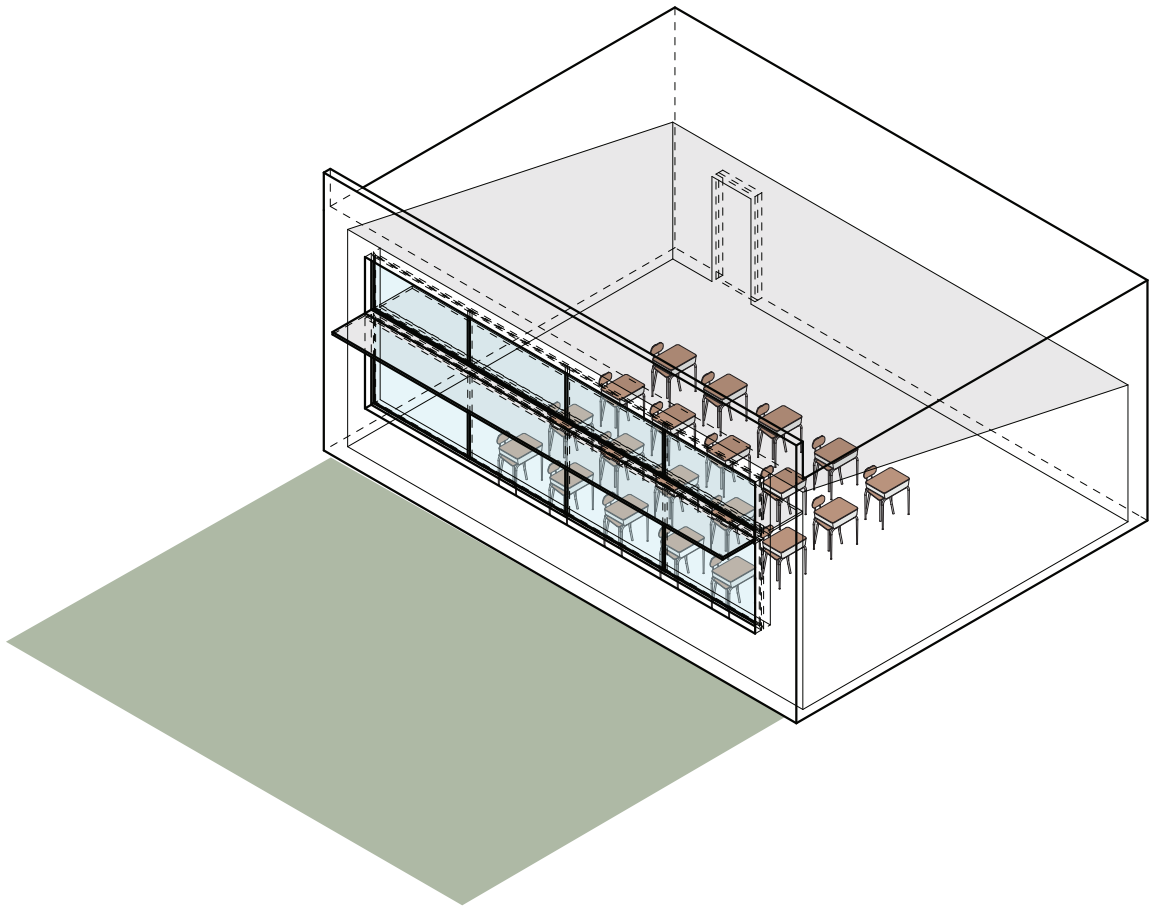


# Access To Green Space And Vegetation:

## Educational Courtyards: Terraced Courtyards Adjacent To Classrooms

The second type of green space incorporated into the proposed Blodgett Middle School is educational courtyards. These spaces are designed to offer each classroom its own outdoor space. These courtyards offer daylight availability, fresh air, and visual relief to the classrooms as well as space for outdoor experiments and classroom instruction during the warmer months.

As a result of these outdoor spaces, students have a greater potential for alertness due to improved air quality and light levels that regulate the students circadian rhythm. Additionally, the visual relief of the courtyards offers comfort and relaxation to the often stressful educational environment.



Terraced, educational courtyards utilize the teared morphology of the building and offer additional classroom space. The Classrooms are designed to open up onto the courtyard if desired through the use of southern exposed sliding aperatures. The courtyards average two thirds of the size of the classroom proper.



# Access To Green Space And Vegetation:

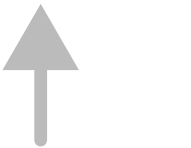
## Terraced Paths & Recreational Zones - Community Gardens



Vegetation

This image demonstrate the type of environment created by the juxtaposition- of outdoor spaces to classrooms. The spaces are connected to the classrooms. Courtyard spaces are usually connected to two classrooms to allow for great- er collaboration when desired by the teachers. Spaces are flexible and can be outfitted with furniture, vegetation, or equipment depending on the schools needs.

In addition to outdoor spaces, these courtyards introduce light, air, comfort and privacy to the classroom spaces. The courtyards are invited into the space to improve student health and comfort.



Air Quality



Mental Relaxation





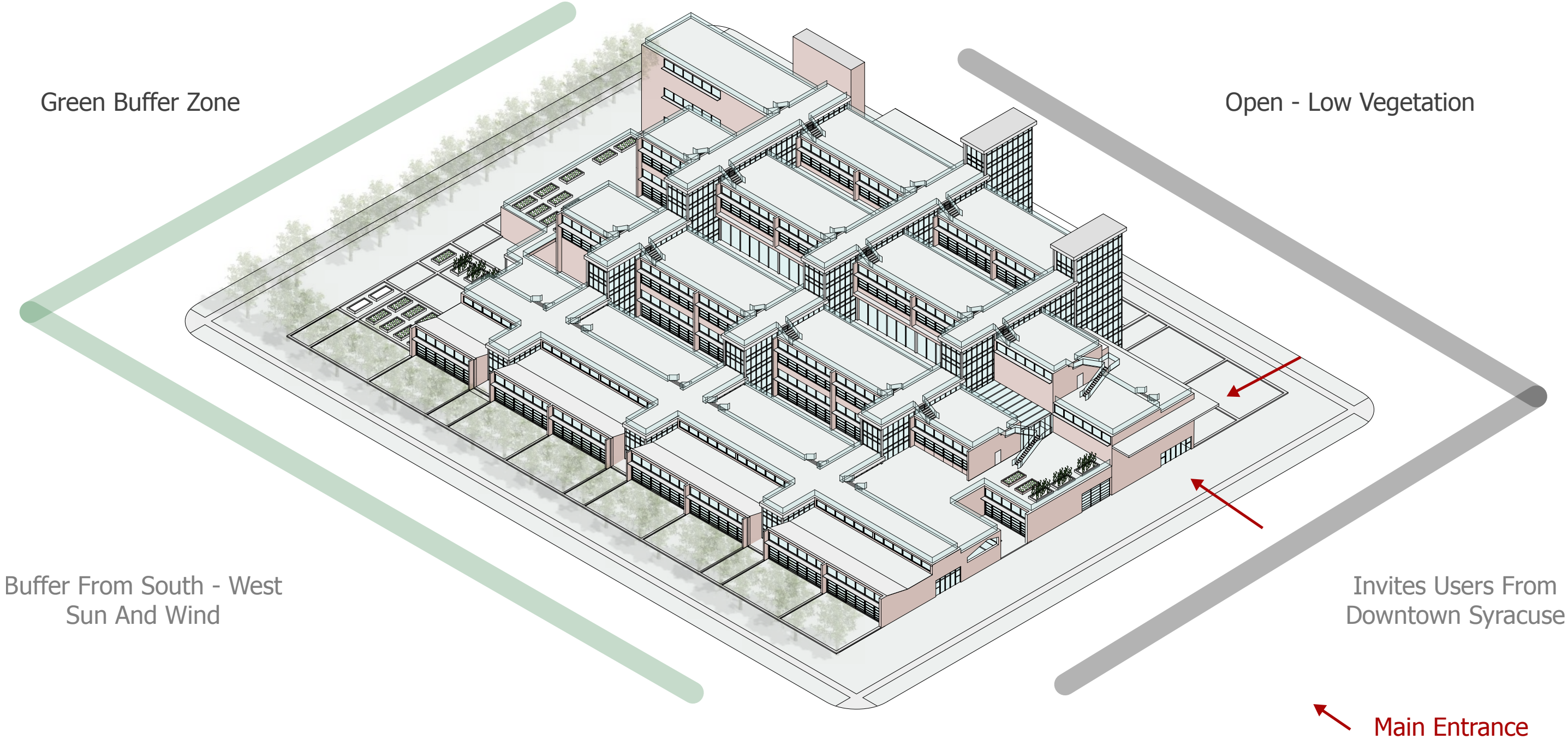
# Access To Green Space And Vegetation: Terraced Paths & Recreational Zones - Community Gardens



Vegetation

The allocation of vegetation at the site scale attempts to interact with the students and the city. The North-East of the site is left open in the direction of downtown syracuse, inviting students and providing a building facade and main entrance while the South-West of the site is buffered from the community to create safe private zones for students during the schoold day.

The use of vegetation on the South-West of the site helps for break the western winds and diffuse the southern sun in the summer months to prevent overheating.



## Resulting Documents and Designs

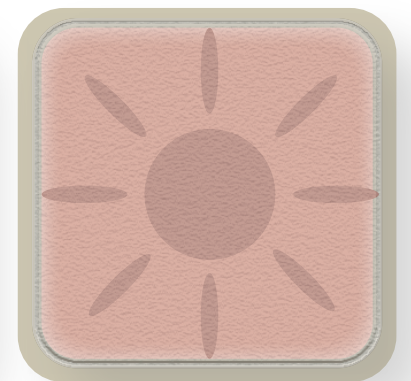
Plans and Sections



Vegetation

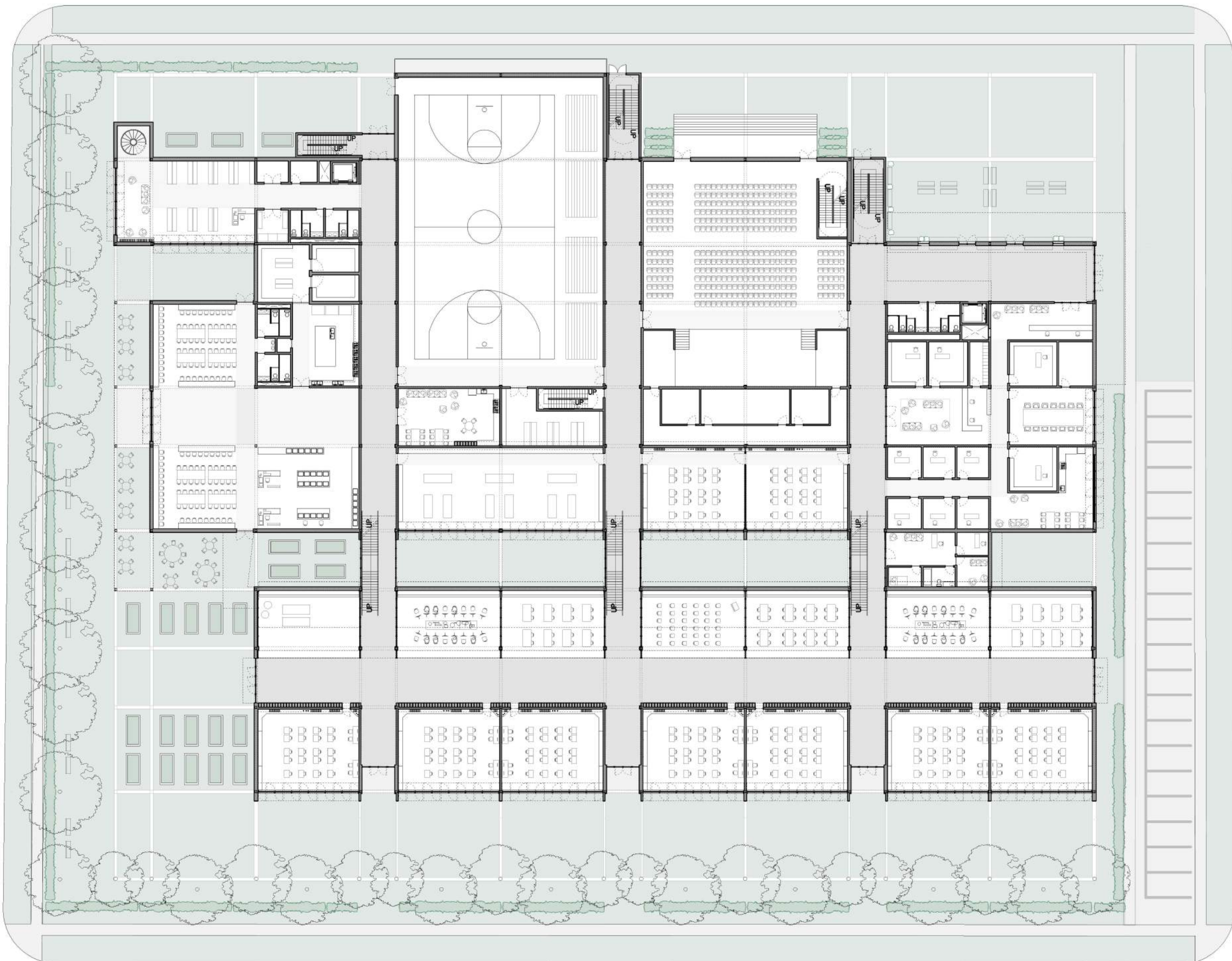


Fresh Air



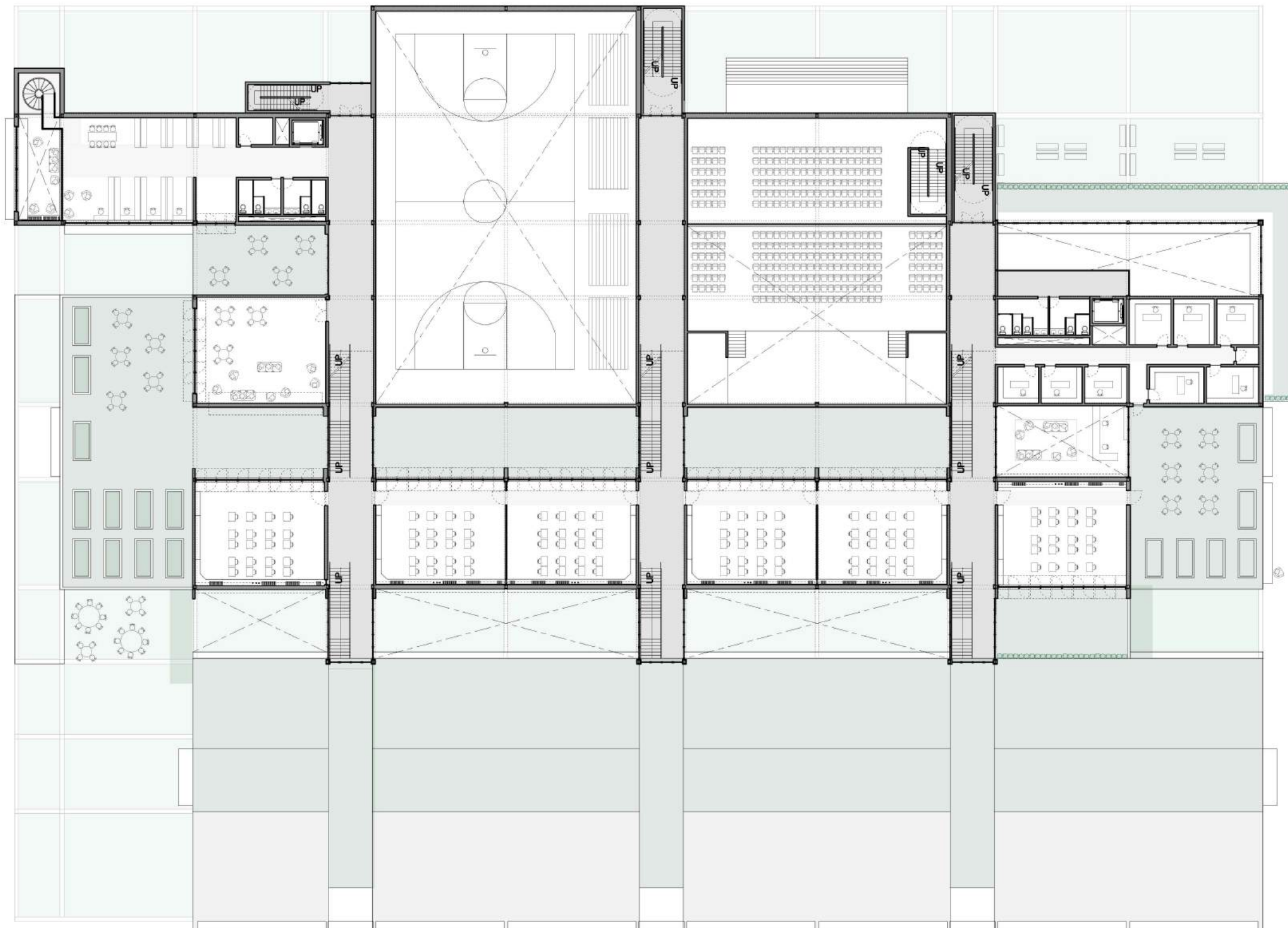
Natural Light





Ground Floor Plan 1":16'





Second Floor Plan 1":16'

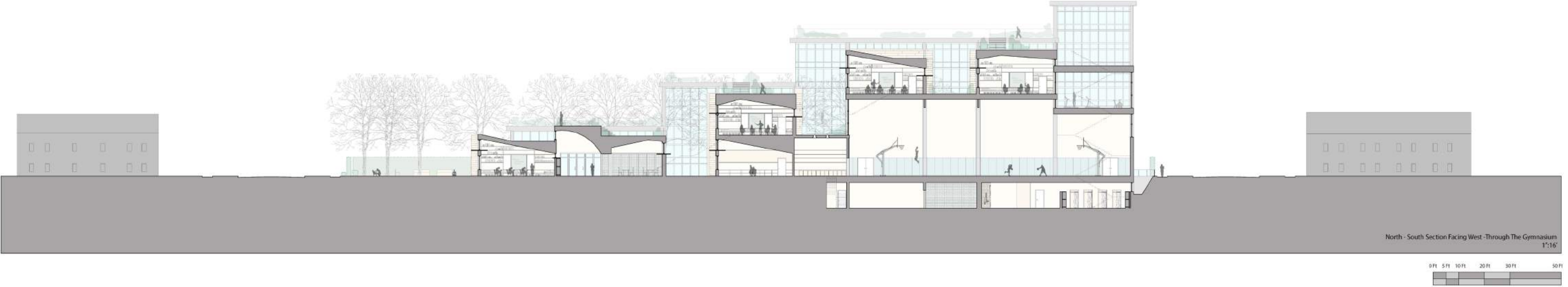
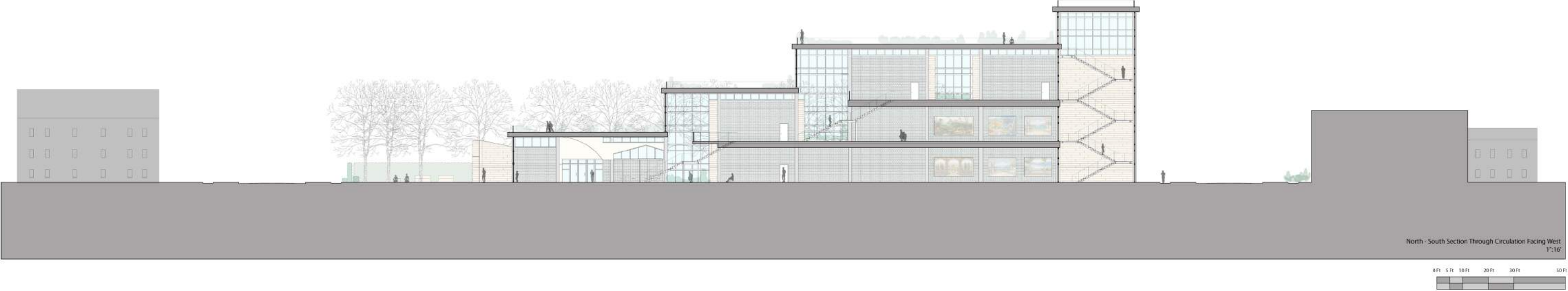


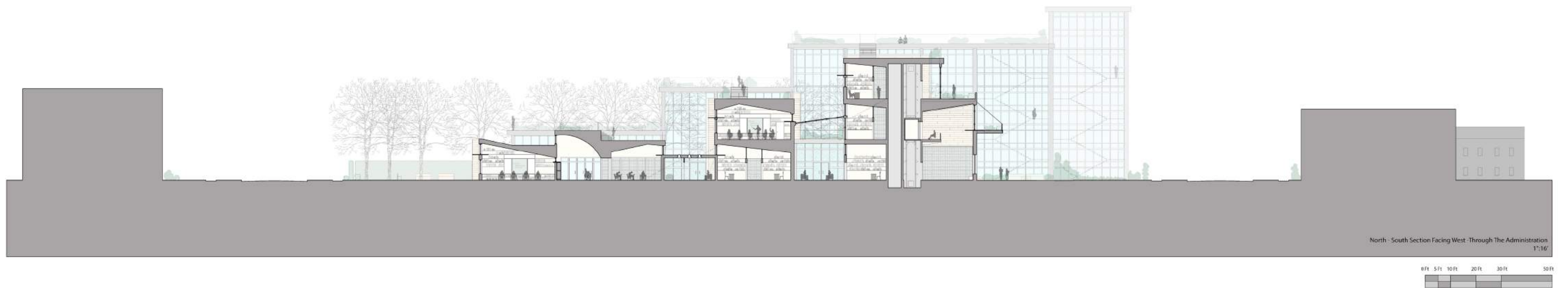
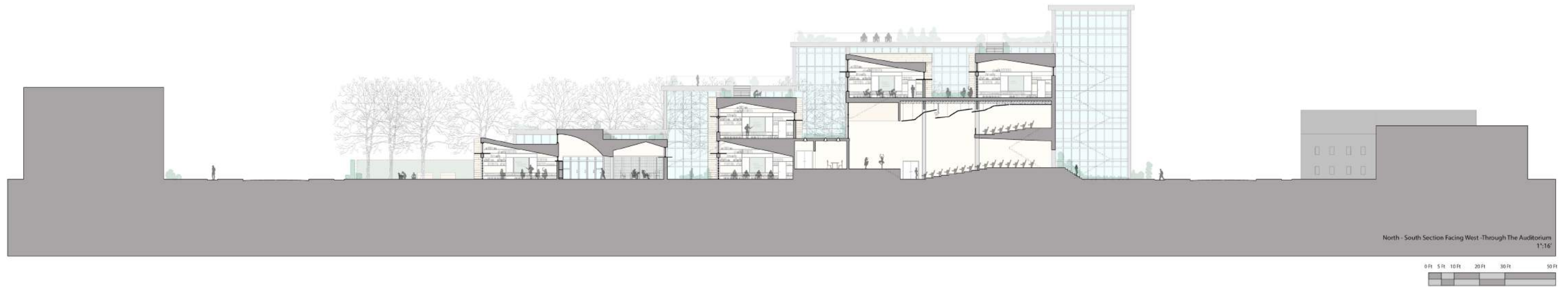




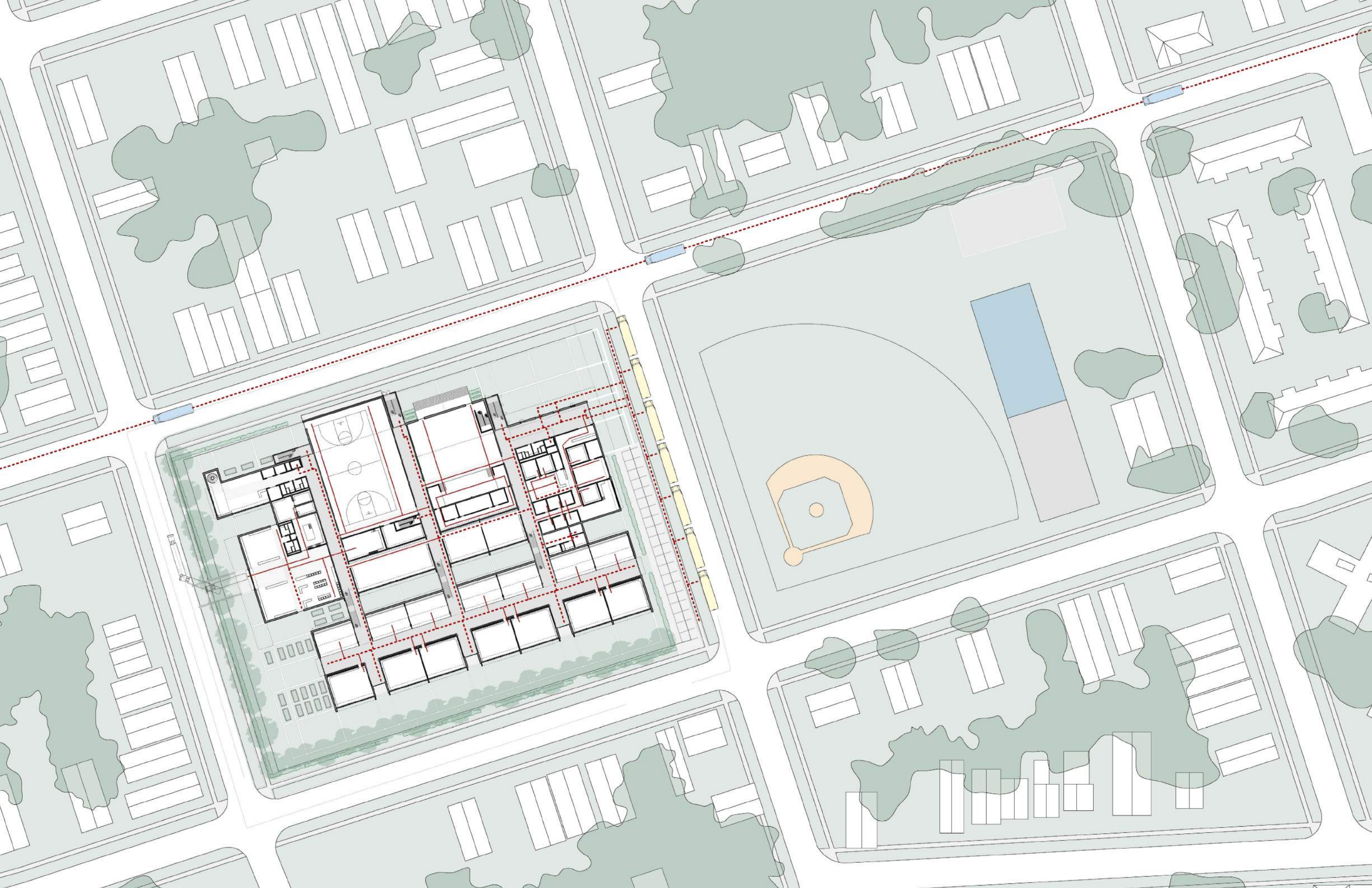
Third Floor Plan 1":16'













Community Education on Healthy living

Connection to local in

## Community

Social Interaction

Digital Networking

Community Support organizations

Clean Water

Daylighting

Nutritious

Day lighting

Green Spa

## Physical Health

Access to fresh air

Physical Activity

Medical facilities